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## THE LANDORE SIEMENS STEEL WORKS, ENGLAND.

Condensed from The Engineer.

The principal novelty upon which the processes in operation in these works are based is Mr. Siemens' regenerative gas furnace, by means of which most intense heats are obtained without cutting flames or deteriorating influences. The steel processes carried on are of two distinct kinds. In the first, which is called the Siemens-Martin process, scrap metal or puddled blooms are dissolved in a bath of pig metal previously prepared on the open hearth of one of these regenerative furnaces, and spiegeleisen is finally added to impart to the metallic bath the requisite percentage of carbon and manganese. In the other process pig metal and iron ores, previously prepared for the purpose, are brought into combination on the hearth of a similar furnace, to produce the same final result, namely, a steel of excellent quality.

The Landore Siemens Steel Company, Limited, was formed three years ago for the manufacture of steel by the processes invented by Mr. C.W. Siemens, C.E. The regenerating gas furnace, which he had previously invented, gave him the power of producing, at a moderate cost, temperatures before unknown in practical metallurgy; consequently, no great time elapsed before he applied this new power to the manufacture of steel, since the intense heat at his command enabled him to keep in a state of fusion, for a lengthened period, a much larger quantity of malleable iron than was practicable before the invention of his furnace. The difference between the Siemens and the Bessemer process of making steel is, that by the former method the metal is kept for any time slowly simmering in a state of fusion, so that, by the addition of varying proportions of the ingredients, at such times as may be convenient to the manager of the furnace, steel of any temper can be made. The process is so completely under control that steel containing any desired quantity of carbon can be made at will, whereas steel containing a predetermined proportion of ingredients can only be made by the Bessemer process with some difficulty. Mr. Siemens, by melting together samples of iron containing different proportions of carbon, produces steel containing any desired quantity of carbon.

The Landore Works were built nearly two and a half years ago; they cover about six acres of ground, on the west bank of the river Tawe, near Swansea, and at the present time they keep about 400 men in constant employment. They consist of fifty two Siemens producers for the manufacture of the gas, a melting shop containing eight furnaces, and a forge department containing two eight tun hammers, capable of hammering 450 tuns a week. There are six reheating furnaces in the forge department. There are also in the works six double puddling furnaces with shingling hammer, and a mill driven by two of Thwaites and Carbutt's 30 inch cylinder engines, with Ramsbottom's reversing gear.

In the mill department there are three double straightening presses, and one double punching press, one "ending" machine, and one cold saw. Some new works are in course of erection, by the same company, on the opposite bank of the river, a little to the north of the Landore viaduct. At present the company do not make their own pig iron, but in the new works four blast furnaces will be erected for the manufacture of pig, which will then be puddled and melted. Sixteen melting furnaces will be built, and five eight tun hammers put up. It is intended to keep a rolling mill at work night and day.

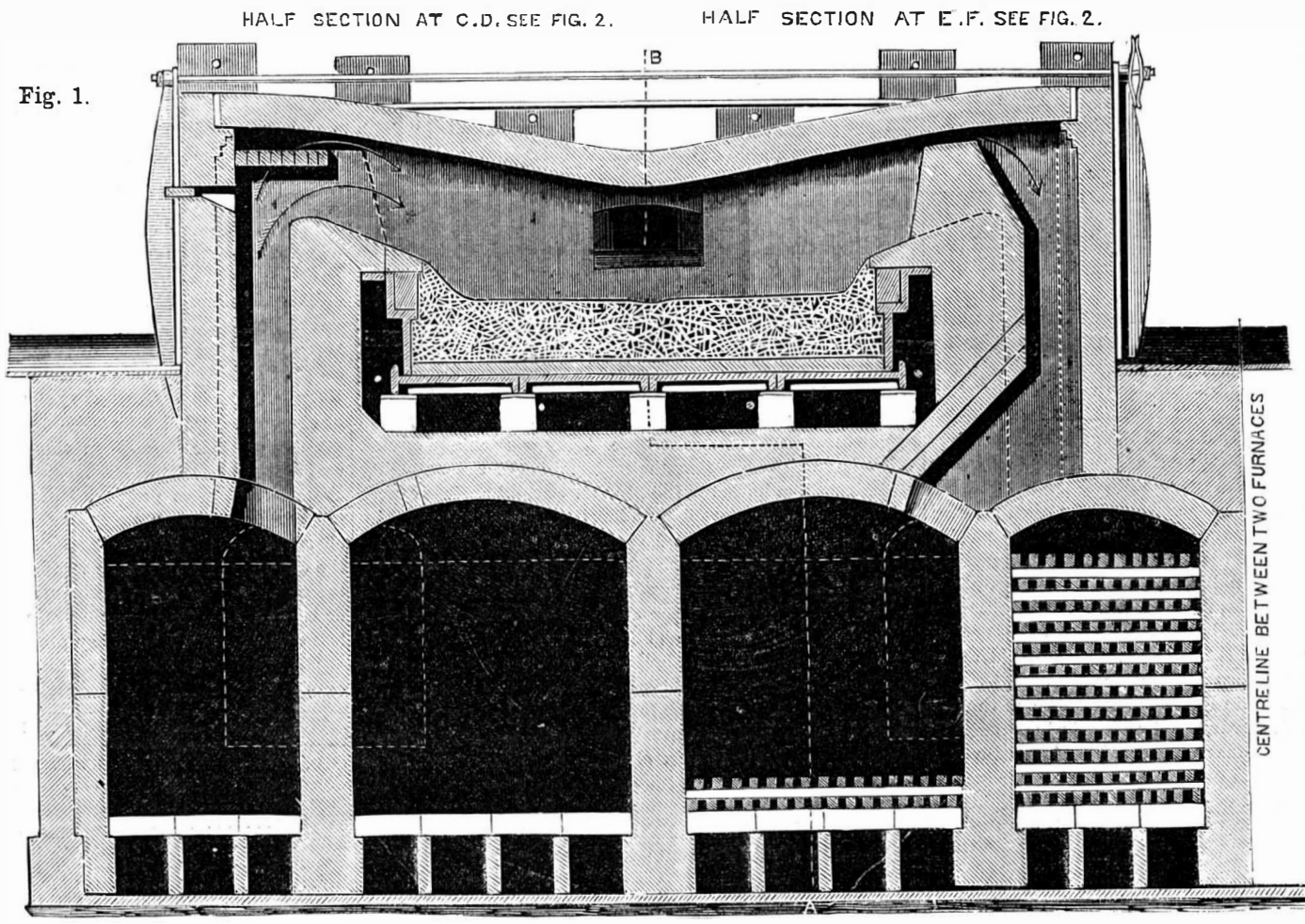
When these new works are completed and the iron trade is brisk, the Landore Siemens Steel Company could find employment for about 1,000 men. In the new steel works gas furnaces only will be used; one great advantage of these furnaces is, that they do not pollute the air with clouds of smoke. The iron ore to feed the blast furnaces will be brought for the most part from Spain.

In the steel works now in operation the fifty-two Siemens producers for the manufacture of gas are arranged in thirteen blocks of four each. The gas is divided into two portions, one of which is conveyed to the melting and puddling furnaces, another portion being conducted by a second large tube to other melting furnaces, and to the heating furnaces for the mill and hammer. The coal used in the manufacture of the gas is obtained from the neighborhood, and consists of equal parts of "slack" of small coal and binding coal.

In the melting shop there are eight furnaces altogether; four of them are for melting up scrap, and about 62 tuns per week are melted in each furnace; the furnaces work about thirteen heats per week. First, about one tun of pig iron is charged in, then sufficient scrap, with very little carbon in, to reduce the carbon in the metal in the furnace to *nil*, or very nearly *nil*. The little carbon in the metal is partly boiled out, and this is one of the peculiarities of the process, for if the charge in the furnace be left to itself, the carbon is slowly boiled away. The necessary amount of carbon to produce steel is introduced by adding spiegeleisen, which at the same time furnishes the requisite quantity of manganese; but after the spiegeleisen is added, it is necessary to tap the furnace as quickly as possible, or the manganese would be burnt away. The pig iron used in the process is of good quality, and as much steel scrap as can be obtained is very quickly used up at the works. The following is a fair sample of an ordinary charge:—20 per cent pig iron, 20 per cent Bessemer scrap, 10 per cent rough puddled iron, 15 per cent Siemens scrap, 15 per cent old iron and borings, 20 per cent shearings.

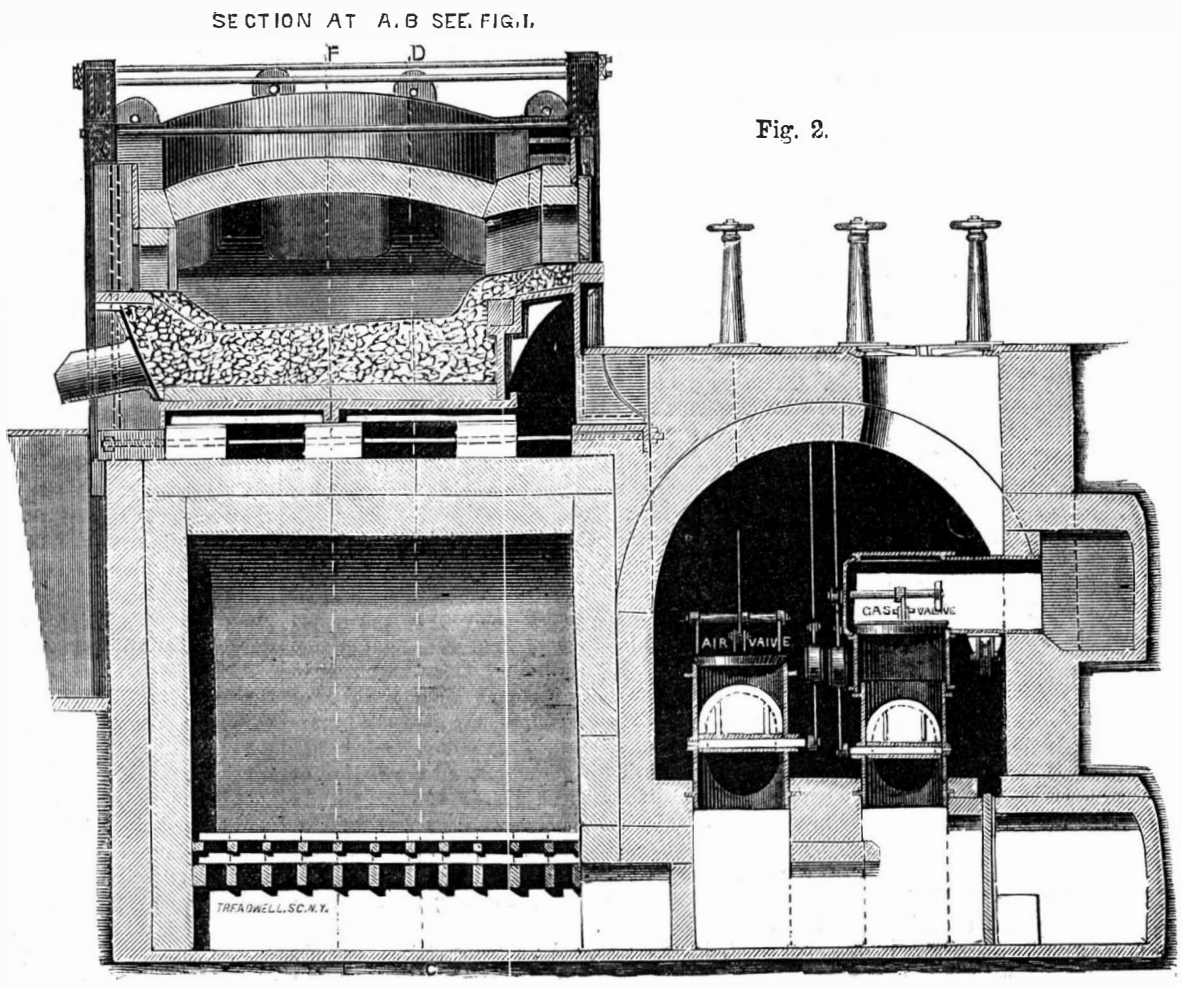
About 7½ per cent of spiegeleisen is then added, which

Fig. 1.




STEEL MELTING FURNACE, SIEMENS STEEL WORKS, LANDORE, ENGLAND.

Fig. 2.

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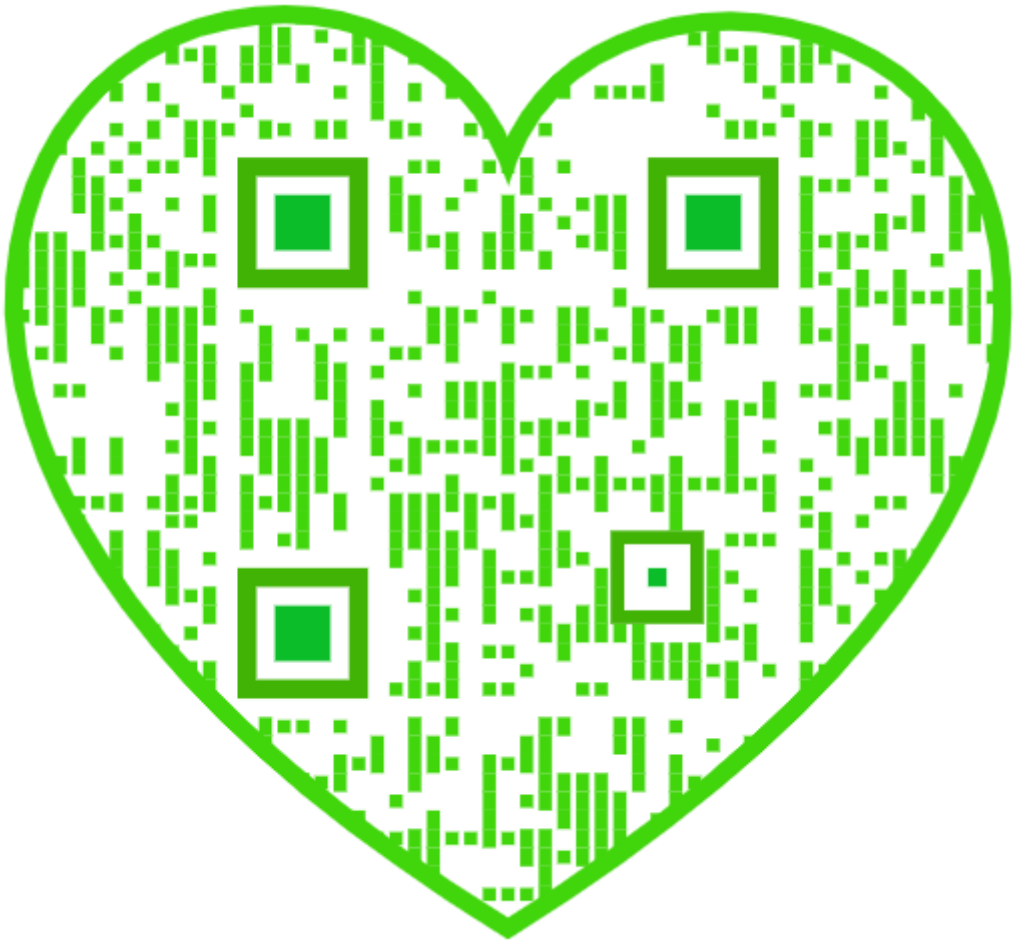

much more than covers the waste. Every now and then a little of the melted metal is taken out in a ladle, and plunged into cold water; the sample is then broken upon an anvil. Its fracture should be bright and crystalline, showing a very small proportion of carbon—not more than 0·1 per cent; it should also be tough and malleable. From 5 to 8 per cent of spiegeleisen, containing not less than 9 per cent of manganese, is thereupon charged through the side openings down upon the bank of the furnace, and allowed to melt down into the bath. The amount of carbon thus introduced determines the temper of the resulting steel. In the event of the sample containing too much carbon, as proved both by its appearance and by chemical analysis, the carbon is allowed to boil out if the furnace is too full, as the addition of more iron might cause accidents; but this boiling out takes time. The quickest way is to add more decarburized iron, if there is room for it in the furnace. In judging the amount of carbon present by the appearance of the sample, the rule is "the more silky the metal, the less carbon does it contain," and, when it is half way between the granular and silky states, then the bath is ready for the spiegeleisen.

The accompanying engravings show the form of the interior of the furnace. In charging it, it is first made quite hot, and then one tun of pig iron is charged in; this takes about an hour to melt, and then fills the bath to the proper level. After it is fairly melted, the men begin to charge the scrap on the bank, where it is allowed to get red hot before it is tumbled down upon the melted pig iron; it would chill the bath if it were added cold. The men keep on placing quantities of more or less carburised metal upon the bank, and tumbling it into the bath when hot, until the bath contains about four tuns, filling it to the proper level. The whole operation occupies seven or eight hours. The time varies a little; on a hot day the furnace will not work so well as on a cold one, because of the draught. After four tuns of iron have been melted, the men begin to take samples out, and then go on charging decarburised iron till the metal gets soft enough, at which point there ought to be about five tuns in the furnace. If it is too hard more shearings are added; if not hard enough a little pig iron is put in. Last of all the spiegeleisen is put in; it is placed on the top of the bank, and tumbled in directly it is warm enough. Then the furnace is quickly emptied, for the forgeability of the steel depends entirely upon getting the charge out directly after the spiegeleisen has been put in, or else the manganese would all be burnt out. The process of melting takes about ten hours from first to last. The furnaces work night and day; there are three men continually attending to each furnace, and they work twelve hours each. At present, however, the mill is working only one shift per day, which turns out 350 tuns of rails per week.

From experiments made in France by M. Sudre, at the expense of Napoleon III., it was found that it is just possible to raise the heat of an ordinary furnace, by means of a fan blast, sufficiently to effect the fusion of tool steel upon the open hearth, but that the cost of the fuel and the rapid destruction of the furnace are commercial obstacles to the use of the method.

In the Siemens steel furnace, the direction of the flame is from end to end, and the regenerators are placed transversely below the bed, which is supported on iron plates kept cool by a current of air; this cooling of the bed is very necessary to keep the slag or melted metal from finding its way through into the regenerator chambers. The bottom of the furnace is formed of siliceous sand. Instead of putting moist sand into the cold furnace, Mr. Siemens calcines the sand, and introduces it into the hot furnace in layers of about one inch in thickness. The heat of the furnace must be sufficient to fuse the surface of each layer; that is to say, it must much exceed a welding heat at the end of the operation, in order to impart additional solidity to the uppermost layers. Care must be taken that the surface of the bath assumes the form of a shallow basin, being deepest near the tap hole. Some white sand—such, for instance, as that from Gornal, near Birmingham—will set, under these circumstances, into a hard, impervious crust, capable of surviving from twenty to thirty charges of liquid steel, without requiring material repair. If no natural sand of proper quality is available, white sand, such as that of Fontainebleau, may be mixed intimately with about 25 per cent of common red sand, when the same result will be obtained. The actual requirement is sand containing about 96 per cent of silica and 4 per cent of alumina or magnesia.

After the steel is melted, it is tapped out of the furnace into a ladle, as in the Bessemer process, and is then run into ingots.

The rails for the Metropolitan Railway, made at the Landore Steel Works, have a flange of $6\frac{3}{8}$ inches across, which is a great width to "bring up" in steel, and can only be done with good metal; the steel, if of second rate quality, will crack along the edges of the flange.

We saw several testing machines in the works where inspectors employed by the different railway companies test the rails before accepting them of the makers. The test for the bridge rails used on the Great Western Railway is a weight of 21 cwt., allowed to fall from a height of 6 feet 4 inches upon the center of a piece of rail supported upon bearings 3 feet 6 inches apart. The blow is repeated three times upon the center of the same piece of rail; and if the center of the rail be then deflected about 7 inches, the steel is considered to be good. Sometimes the result is a deflection of not more than 5 or 6 inches, and sometimes the piece of rail breaks, but not often.

The total fall of the machine is 24 feet, upon an anvil block of solid iron weighing 15 tons. The rigidity of the anvil is an important point in testing steel rails or bars.

The test of the Bristol and Exeter Railway Company is a 10 feet fall of 2,240 lbs.; three blows; 5 feet bearings.

The rails for the Metropolitan Company weigh 86 lbs. to the yard, and are tested, not by a falling weight, but by the dead weight produced by hydraulic pressure. A piece of the rail is placed upon 5 feet bearings, and a slightly curved iron surface $3\frac{3}{4}$ inches in width is made to press upon the center of the sample rail selected for testing. The test is that under these conditions a pressure of 40,000 lbs. shall not deflect the centre of the rail more than 1 inch; also that 60,000 lbs. shall deflect it 9 inches without breaking it.

A steel rail has fully six times the life of an iron rail, and the difference in price between them is about £5 per ton. Steel rails now cost £12 per ton.

There is a laboratory attached to the Landore Steel Works, under the direction of Mr. A. Wallis, where every sample of iron which enters the melting furnaces is first analysed to ascertain the proportion it contains of sulphur, phosphorus, and silicon. Every charge from the melting furnaces is tried also by the color test for carbon. If the proportion of carbon is found to be rather high, a rail is rolled and a piece of it cut off and tested before the remainder of the ingots are hammered. If it does not stand the test, the ingots are sent back to the furnaces.

## DURABILITY OF TIMBER.

The following is an extract from the new edition of "Tredgold on Carpentry," edited by John Thomas Hurst, and noticed in another column:

Of the durability of timber in a wet state, the piles of the bridge, built by the Emperor Trajan across the Danube, are an example. One of these piles was taken up, and found to be petrified to the depth of three fourths of an inch; but the rest of the wood was little different from its ordinary state, though it had been driven more than sixteen centuries.

The piles under the piers of old London Bridge had been driven about 600 years, and, from Mr. Dance's observations in 1746, it did not appear that they were materially decayed; indeed they were found to the last to be sufficiently sound to support the massy superstructure. They were chiefly of elm.

We have also some remarkable instances of the durability of timber when buried in the ground. Several ancient canoes have been found, in cutting drains through the fens in Lincolnshire, which must have lain there for many ages. In the *Journal of Science*, etc., published at the Royal Institution, one of these canoes is described, which was found at the depth of eight feet below the surface of the ground. It was 30 feet and 8 inches long, and 3 feet wide in the widest part, and appears to have been hollowed out of an oak tree of remarkably fine free grained timber.

Also, in digging away the foundation of old Savoy Palace, London, which was built nearly 700 years ago, the whole of the piles, consisting of oak, elm, beech, and chestnut, were found in a state of perfect soundness; as also was the planking which covered the pile heads. Some of the beech, however, after being exposed to the air for a few weeks, though under cover, acquired a coating of fungus over its surface.

On opening one of the tombs at Thebes, M. Belzoni discovered two statues of wood, a little larger than life, and in good preservation; the only decayed parts being the sockets to receive the eyes. The wood of these statues is probably the oldest in existence that bears the traces of human labor.

A continued range or curb of timber was discovered in pulling down a part of the Keep of Tunbridge Castle, in Kent, which was built about 750 years ago. This curb had been built into the middle of the thickness of the wall, and was no doubt intended to prevent the settlements likely to happen in such heavy piles of building; and therefore is an interesting fact in the history of constructive architecture, as well as an instance of the durability of timber.

In digging for the foundations of the present house at Ditton Park, near Windsor, the timbers of a drawbridge were discovered about ten feet below the surface of the ground; these timbers were sound but had become black. Hakewell says that Sir John de Molines obtained liberty to fortify the Manor house of Ditton, in 1396; and it is most probable the drawbridge was erected soon after that time; and accordingly the timber had been there about 400 years.

The durability of the framed timbers of buildings is also very considerable. The trusses of the old part of the roof of the Basilica of St. Paul, at Rome, were framed in 816, and were sound and good in 1814, a space of nearly a thousand years. These trusses are of fir.

The timber work of the external domes of the Church of St. Mark, at Venice, is more than 840 years old, and is still in a good state. And Alberti observed the gates of cypress to the Church of St. Peter, at Rome, to be whole and sound after being up nearly 600 years.

The inner roof of the Chapel of St. Nicholas, King's Lynn, Norfolk, is of oak, and was constructed about 500 years ago.

Daviller states, as an instance of the durability of fir, that the large dormitory, of the Jacobins' Convent at Paris, had been executed in fir, and lasted 400 years.

The timber roof of Crosby Hall, in London, removed in 1869, was executed about 400 years ago; and the roof of Westminster Hall, which is of oak, is now above 340 years old.

The rich carvings in oak which ornamented the ceiling of the king's room in Stirling Castle, are many of them still in good preservation. It is nearly 360 years since they were executed, and they remained in their original situation till a part of the roof gave way, in 1777, when the whole was removed, and has since been dispersed among the collectors of curious relics of old times.

Moreton Hall, in Cheshire, where "the staircase winds round the trunk of an immense oak tree," and the building itself is chiefly constructed of wood, has now existed nearly 300 years.

And Mr. Britton describes an old house at Islington, constructed chiefly of wood, which he has ascertained to be about 240 years old.

Other notices of extraordinary durability will be found in the descriptions of the different kinds of wood. But enough already has been collected to show that timber is very durable where nothing more than ordinary means have been used to render it so; that is, nothing more than judicious selection and good seasoning.

Every permanent support should be formed of a good and sound piece of timber; inferior kinds should be used only for temporary purposes, or where no strain occurs, and where they can be easily renewed without injury to the strength of the building.

Mr. Barrow, in writing on this subject, very judiciously remarks, "that the felling of timber while young and full of vigor, making use of the sapwood, and applying it to ships and buildings in an unseasoned state, have no doubt contributed to make the disease of dry rot infinitely more frequent and extensive than it was in former times, when our ships were hearts of oak, and when, in our large mansions, the wind was suffered to blow freely through them, and a current of air to circulate through the wide space left between the paneled wainscot and the wall. In those old mansions, which yet remain, and in the ancient cathedrals and churches, we find nothing like dry rot, though perhaps

"perforated sore
And drilled in holes, the solid oak is found
By worms voracious eaten through and through."

In regard to the durability of different woods, the most odoriferous kinds are generally considered to be the most durable; also woods of a close and compact texture are generally more durable than those that are open and porous, but there are exceptions, as the wood of the evergreen oak is more compact than that of the common oak, but not nearly so durable.

Sir H. Davy has observed that, "in general, the quantity of charcoal afforded by woods offers a tolerably accurate indication of their durability; those most abundant in charcoal and earthy matter are most permanent; and those that contain the largest proportion of gaseous elements are the most destructible. "Amongst our own trees," he adds, "the chestnut and the oak are pre-eminent as to durability, and the chestnut affords rather more carbonaceous matter than the oak. But we know from experience, that red or yellow fir is as durable as oak in most situations, though it produces less charcoal by the ordinary process. The following table of the quantity of charcoal afforded by 100 parts of different woods is added, for the information of the reader:—

| Kind of Wood. | Watson. | Mushet. | Proust | Rumford. |
|---|---|---|---|---|
| Oak, dry | 22·92 | 22·6 | 19 | 43 |
| Chestnut | .... | 23·2 | .. | .... |
| Mahogany | 20.82 | 25·4 | .. | .... |
| Walnut | 26·04 | 20·6 | .. | .... |
| Elm | .... | 19·5 | .. | 43·27 |
| Beech | .... | 19·9 | .. | .... |
| Fir | 15·62 | .... | .. | 44·18 |
| Norway Pine | .... | 19·2 | .. | .... |
| Pine | .... | .... | 20 | .... |
| Scotch Pine | .... | 16·4 | .. | .... |
| Ash | 17·71 | 17·9 | 17 | .... |
| Poplar | .... | .... | .. | 43·57 |
| Lime | .... | .... | .. | 43 59 |
| Birch | .... | 17·4 | .. | .... |
| Sycamore | .... | 19·7 | .. | .... |
| Sallow | .... | 18·4 | .. | .... |

In Count Rumford's experiments a longer period was allowed for the process; and, in consequence, his results represent more nearly the real quantities of carbon in each wood than the others. But even according to the common process, it does not appear that the proportion of charcoal is a satisfactory criterion of the durability.

An experiment to determine the comparative durability of different woods is related in Young's "Annals of Agriculture," which will be more satisfactory than any speculative opinion; and it is much to be regretted that such experiments have not been oftener made.

"Inch and half planks of trees from thirty to forty-five years' growth, after ten years' standing in the weather, were examined and found to be in the following state and condition:—

Cedar, perfectly sound; larch, the heart sound, but sap quite decayed; spruce fir, sound; silver fir, in decay; Scotch fir, much decayed; pinaster, quite rotten; chestnut, perfectly sound; abele, sound; beech, sound; walnut, in decay; sycamore, much decayed; birch, quite rotten.

This shows at once the kinds that are best adapted to resist the weather; but even in the same kind of wood there is much difference in the durability, and the observation is as old as Pliny, that "the timber of those trees which grow in moist and shady places is not so good as that which comes from a more exposed situation, nor is it so close, substantial, and durable;" and Vitruvius has made similar observations.

Also split timber is more durable than sawed timber, for the fissure in splitting follows the grain, and leaves it whole, whereas the saw divides the fibres, and moisture finds more ready access to the internal parts of the wood. Split timber is also stronger than sawed timber because the fibers, being continuous, resist by means of their longitudinal strength; but when divided by the saw, the resistance often depends upon the lateral cohesion of the fibers, which is in some woods only one twentieth of the direct cohesion of the same fibers. For the same reason whole trees are stronger than specimens, unless the specimens be selected of a straight grain, but the difference in large scantlings is so small as not to be deserving of notice in practice.

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### The Practical Philosophy of Gas Burning.

The secret of gas consumption is to secure good burners, to adapt them to the supply of gas, and to understand the simple principles by which the supply should be regulated. Probably nineteen twentieths of the gas burners now in use throughout the country are of irremediably bad construction, the most economical plan of dealing with which would be to throw them aside at once. A report to the London Board of Trade by the gas referees, containing "the result of their investigations of the principles which regulate the development of light from gas, and the application of those principles to the construction and use of burners in the manner most advantageous and economical to the public," forms the subject of an article in the *Spectator*. That journal says: "If any one is inclined to look contemptuously on so small a matter as the improvement of gas burners, a few of the facts stated in the report will, if he have any of the Englishman's regard for his pocket, very decidedly convert him to a sense of its importance. On an average, consumers of gas, by using well constructed and well adapted burners, instead of the usual clumsy, haphazard kind, may reduce their gas bills by one third or one half of the whole amount, while obtaining a stronger and more steady light than they obtained before. In a middle class household the gas bill is no inconsiderable item; and, even if the health of the family were not concerned, it would surely be desirable to control in some measure the unnecessary and expensive consumption. But we know the carelessness and contempt for thrift which prevails in these countries. It is more remarkable that in great business establishments, where the charges for gas must be of necessity enormous, some effort at improving the burners has not been made. The referees, having examined a quantity of burners supplied by the leading gas fitting firms, and having found the majority hopelessly defective, brought the matter to a practical test by visiting certain establishments, in the city, where night work prevails. As an instance of the waste in such places, we are informed that in the publishing offices of two great daily papers the burners chiefly in use gave out only one half the light that the gas supplied was capable of giving, while a large number furnished only one quarter of the true illuminating power. As compositors and other newspaper *employés* must have a strong light, it is clear that the place of this wasted power had to be supplied by additional burners. In private houses the loss is not so outrageous as this, but it is considerable almost everywhere, and the report affirms that, on a most moderate estimate, one fourth of the annual gas rental of London might be saved by the use of good burners. This rental is £2,000,000 a year, so that it is plain we are throwing away half a million per annum in mere heedless ignorance. Nor are we committing this waste with impunity. By the use of perfect burners we burn less gas to obtain the necessary quantity of light, and the less gas we burn the less do we pollute the air with the noxious products of combustion. The amount of these products, too, is diminished by the employment of burners which completely consume the gas supplied to them. It is obvious, therefore, that the use of ill contrived burners in large establishments, and the resulting waste described may be a prevalent cause of the ill health from which newspaper printers and other night workers suffer.

A good gas burner is not an imaginary article, although a perfect burner has yet to be discovered. The referees in their recent inquiries and experiments have taken as a standard "Sugg's London Argand Burner No. 1," which is not the best invented by the maker, but seems at present the one most adapted for practical use. Comparing with this burner, when burning five feet of gas per hour, those in common use under the names "fish tail" and "bat wing" burners, we obtain some remarkable results. Taking the standard burner's illuminating power at 100, six fish tail burners gave these results:—73, 62, 52, 46, 36, and 19, the latter giving less than one fifth of the light supplied by the standard at the same consumption of gas. The bat wing burners show better results, being 86 and 82, as compared with the standard. It must be observed, however, that the standard is an Argand burner, in which the supply of air to the flame is regulated by a chimney. Comparing three other Argands with the standard, we find the illuminating power still far inferior, being no more than 78, 77, and 34 per cent respectively. These tests clearly prove the superiority, of Sugg's Argand No. 1, to any burner in common use. Of course it remains a question in particular instances whether the cost of supplying these burners would be too great to admit of their general adoption.

A burner is to gas and the development of light, as the report points out, what a boiler is to coal and the generation of steam. In the early days of the steam engine, before boilers were properly adapted to their work, there was an enormous waste of power, so that "one ton of coal in a locomotive of the present day generates as much force as six tons did forty years ago." But a well constructed boiler is fitted to do its work best when consuming a fixed quantity of fuel, and there is in, like manner, in the case of every gas burner, a certain rate of consumption at which the highest illuminating power in proportion to the supply is attained. Above or below this point there must be more or less waste, and there is as much above it as below it. This is a fact which deserves to be taken into account, for many consumers fancy that the more gas they turn on the better light they will get. It is now conclusively established that the quantity of gas does not influence the development of light, that the difference perceived, in the illuminating power afforded by the consumption of different quantities of the same gas, is due to the difference of the burners, each burner "doing justice" to the gas at a particular rate of consumption, and declining in illuminating power when the supply falls short of this rate or exceeds it. It has been proved also that the temperature at which the gas is supplied to the burner makes no practical difference to the light, that an over supply of air to the flame and an excess of pressure in the supply pipe are adverse to illuminating power. Gas, it appears, is in the fittest state to be burned, and to give out its maximum of light, when it streams through the burner under little or no pressure, flowing upwards like a natural flame. The practical suggestion deducible from these conclusions is, that the burners should be improved; and we have called attention to the best type yet brought into use."

### The Metric System in the United States.

President Barnard, in his address before the University Convention of the State of New York, on the French metric system, said: "According to the best authorities I have been able to find, the total population of Europe approaches 260,000,000, of whom 135,000,000 have already accepted the metric system in all its details, or have given, to all the standard units of their own system, metric values. Add to these 25,000,000 more in Mexico and South America, and we have a total of 160,000,000 of civilized people in civilized lands who are irrevocably committed to the metric system, while a considerable proportion of the rest have made progress toward the system by adopting metric values in part, like Denmark, Austria and Turkey; or by adopting the decimal law of derivation without as yet the metric values, like Sweden; and 70,000,000 more, the people of the British Islands and of the United States, have made the denominations of the system lawful in all business transactions within their territory. All this has been accomplished by the pressure of public opinion; it has been distinctly a movement of the people and not of government: it is a social rather than a political phenomenon." In connection with the above, says the *Evening Post*, the following information, recently given by Mr. Hilgard, of the United States Coast Survey, to the *Journal of the Franklin Institute*, will be interesting: There are, in the custody of the Treasury Department, at the Office of Weights and Measures, the following authentic copies of the standard meter and kilogramme of France, viz.: Meter of platinum, compared and certified by Arago; meter of steel, compared and certified by Silbermann; kilogramme of platinum, compared and certified by Arago; kilogramme of brass (gilt), compared and certified by Silbermann. The length of the meter is 39·3685 inches of the United States standard scale, and the kilogramme is 15432·2 grains, or 2 lbs., 3 ozs., 119·7 grs. avoirdupois. There is also another meter, the property of the American Philosophical Society, which is one of the twelve original meters made by the French Government, and was brought to this country by Mr. Hassler, the originator of the United States Coast Survey. A comparison between this bar and the standard of France at the Conservatory of Arts and Trades was made by Dr. F. A. P. Barnard, with the result that, at the temperature of melting ice, there is no appreciable difference, by the most delicate means of comparison, between the platinum standard of the Conservatory and this iron meter. It is, therefore, possible for the Office of Weights and Measures to reproduce, for distribution to the different states, metric standards of great accuracy.

### Manual Labor and Maximum Air Temperature.

There is some interesting information, on the maximum temperature of air which is compatible with the healthful exercise of human labor, in the report of the English commissioners appointed to inquire into the several matters relating to coal in the United Kingdom, just issued, the abstract of which we find in the *American Exchange and Review*. The committee, who undertook to determine the maximum depth to which it would be possible to work coal, found this question very difficult to decide. Evidence was given of extraordinary temperatures endured in the stock holes of steamers, and in places where glass blowers work. In some of these cases labor has been carried on, without serious detriment to health, where the thermometer has indicated 180° Fahr. In these instances, however, the thermometer was chiefly acted on by radiant heat, and therefore did not truly indicate the actual temperature of the air. In an experiment made under the direction of the committee, it was found that a thermometer, suspended in a stock hole and exposed to the radiation from the boilers, indicated a temperature of 105°; while another thermometer in the same position, but carefully screened from the radiant heat, stood at only 78°. It is important, also, to observe that the men who work in stock holes and glass houses have ready access to the external air, and avail themselves of numerous intervals in their labor to cool themselves. One of the medical witnesses, who had spent a great part of his life in tropical climates, states that he had experienced a temperature of 125° Fahr. in the shade, and that this great heat was rendered endurable by the dryness of the atmosphere; on the other hand, he had felt a damp atmosphere almost intolerable at the comparative low temperature of 86°.

The committee had information of mining work being executed in a Cornish mine, where the air was heated by a hot spring to a temperature alleged to amount to 117°, and was also by the same cause saturated with moisture. Dr. Sanderson was deputed to visit this mine and make an investigation. He found the highest temperature to exist at the extremity of an excavation forming a short *cul de sac*, where a stream of water entered at a temperature of 114½°. At a distance of a yard from the end of this *cul de sac* the thermometer indicated a temperature of 103°; but at a distance of only ten feet there was access to air, where the theremometer stood at 81°. According to other evidence, the temperature of the air occasionally reached 123°. The miners remained in their workings six hours out of the twenty-four. Four men were employed at a time, of whom two were always at rest in the cool air, and the other two were not always at work. The total duration of each man's work was less than three hours in the twenty-four. No miner remained more than fifteen minutes in the heat at one time. The condition of each miner on retreating into cool air is described as one of complete exhaustion; but by allowing cool water to pour over his body, the distress and exhaustion quickly passed off. Dr. Sanderson came to the conclusion that the occupation in question was not necessarily inconsistent with the enjoyment of vigorous health; but he found that there were many men who, after trying the work, were compelled to desist on account of the distress and exhaustion which were produced. It is Dr. Sanderson's opinion that labor is not practicable in moist air of a temperature equal to that of the blood, namely, 98°, excepting for very short intervals; and this conclusion is in harmony with the other medical evidence. The question of maximum temperature under which work could be carried on in a coal mine hinges, in a great measure, on the hygrometric condition of the air. The depth, at which the temperature of the air would, under present conditions, become equal to the heat of the blood, would be about 3,420 feet. Beyond this point the considerations affecting increase of depth and temperature become so speculative that the committee felt it necessary to leave the question in uncertainty; but looking to possible expedients which the future may elicit for reducing the temperature, they considered it might fairly be assumed that a depth of at least 4,000 feet might be reached.

### Employments for Boys.

In a recent number, we published an article on the propriety of supplying boys with tools, that, in their leisure hours, they may be occupied with healthy and useful employment. In the last number of our most estimable exchange, the *Congregationalist*, of Boston, we find the same subject discussed:

In every family where there are boys, from six to twelve years of age, it is much of the time a pressing question what to do with them: how to employ their thoughts and their hands out of school time. This question is all the more important in view of the extreme desirability of keeping them, at their age, off the streets and away from unhealthful associations, and it is all the more pressing now that the winter, with its out-door cold and long evenings, is at hand. Making due allowance for skating, sledding, and kindred sports, the boys are to be shut up in the house more or less of the time for six months to come, and something else must be found to occupy them than books and study. What now shall it be?

One unfailing resource for boys of certain taste—and a large class they are—is an assortment of carpenter's tools, with a suitable place in which to work. Put a boy of a mechanical turn of mind in possession of a little room which he may call his shop, give him a bench, a set of planes, a couple of saws, a few chisels and gouges, several pounds of nails of different sizes, and a variety of good clear "stuff," and you have provided him with the materials for unfailing recreation. He will, doubtless, make a noise, and perhaps cut his fingers; but worse things than either of these may happen. He will waste his nails and his boards, and, and at first, may spoil his tools; but no matter. The money spent for them will be money well spent, and the return for it, in the providing of a healthful, harmless, attractive occupation, will be prompt and large. We speak that we do know, and testify that we have seen.

Another excellent thing to put into a boy's hands is a small printing press with its accompanying outfit, by no means an extensive or cumbersome or complicated affair, but one which is altogether suited to the capacities of any intelligent lad of ten or a dozen years. We have particularly in mind a small sized Novelty Press, so called, which is simple, compact, and easily worked. Having a small font of type, ink, paper, a press, and his wits at work, who shall say what typographical triumphs our boy may not produce? He may blacken his hands; but there are far deeper stains than those of printer's ink. The printing establishment will quicken the boy's mind as well as exercise his fingers—for he must be his own editor; composer as well as compositor; proof reader as well as pressman.

When this article was projected—composed, in fact—we had not a thought of the arrangements just announced whereby we are able to offer tool chests and Novelty printing presses as premiums for new subscribers to the *Congregationalist*. But we are now pleased to think that the paper may serve as a means of placing these really valuable articles in many families where we are sure they will render a most useful ministry in the manner indicated.

There is this additional reflection. The boy who half plays, half works in a miniature shop, or with a miniature printing office, is certain to familiarize himself with the rudiments of a trade, of which he *may* find it very convenient to know something in after days.

WE have, says *Nature*, on various occasions, alluded to the large amount of encouragement to the pursuit of science afforded by the governing powers of the United States, both by the Central Federal Government at Washington, and by those of the individual states. The sums of money voted for such purposes by our American relations would make the hair of our economical Government officials in this country stand on end, and would be certain to provoke angry comment in our House of Commons; while the number of scientific men, paid for carrying out the investigations and preparing reports on various subjects of great practical value for the welfare of the country, would almost bear comparison with the number we pay for doing nothing or for obstructing all rational improvements.

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### Life in Japan.

The following are extracts from a volume of "Travels in Japan," from the pen of Bayard Taylor, Esq., just published by Scribner & Co., 654 Broadway, N. Y.

RICE PLANTING IN JAPAN.

"As we advanced through the country, both men and women were busily employed in planting out their rice. This was the first time I had seen any but isolated cases of women being engaged in field labor in Japan; for the Japanese appear to me to be honorably distinguished among nations of a higher civilization, in that they leave their women to the lighter work of the house, and perform themselves the harder out door labor. Indeed, I was at first in some doubt here, for it was by no means easy to distinguish the women from the men at a little distance. To guard the legs, probably from leeches, as they paddled in the mud, they all wore gaiters up to the knees and short cotton trowsers. When the neck was covered, there was no very distinguishing difference between the sexes, as the men never have any hair about the face. The wheat in Japan never appears to be sown broadcast. All that I have seen has been drilled and planted in rows, much as the rice is, a few stalks together. Labor is cheap, and it is to be presumed they find this the more profitable way."

JAPANESE JUGGLERS.

"The jugglers and mountebanks are also distinguished by the variety and originality of their feats. For instance, they perform a series of tricks by means of an enormously long false nose. One will lie down on his back, with a boy balanced on the end of the nose, the boy supporting an open umbrella on the end of his own nose. Another will hold up his foot, upon the sole of which a boy plants his nose, and balances himself in the air. Some of these feats seem impossible, without the aid of some concealed machinery.

"I was witness to some astonishing specimens of illusion. After a variety of tricks with tops, cups of water, and paper butterflies, the juggler exhibited to the spectator a large open fan which he held in his right hand, then threw into air, caught by the handle in his left hand, squatted down, fanned himself, and then turning his head in profile, gave a long sigh, during which the image of a galloping horse issued from his mouth. Still fanning himself, he shook from his right sleeve an army of little men, who presently, bowing and dancing, vanished from sight. Then he bowed, closed the fan, and held it in his two hands, during which time his own head disappeared, then became visible, but of colossal size, and finally reappeared in its natural dimensions, but multiplied four or five times. They set a jar before him, and in a short time he issued from the neck, rose slowly into the air, and vanished in clouds along the ceiling.

"At the fair of Asaksa, in addition to the performances of jugglers of all kinds, there are collections of animals which have been taught to perform tricks—bears of Yeso, spaniels which are valuable in proportion to their ugliness, educated monkeys and goats. Birds and fish are also displayed in great quantities. But the most astonishing patience is manifested by an old Corean boatman, who has trained a dozen tortoises, large and small, employing no other means to direct them than his songs and a small metal drum. They march in line, execute various evolutions, and conclude by climbing upon a low table, the larger ones forming, of their own accord, a bridge for the smaller, to whom the feat would otherwise be impossible. When they have all mounted, they dispose themselves in three or four piles like so many plates.

JAPANESE GYMNASTS.

M. Humbert gives the following description of the performances of this class, both in the streets and booths. "In the public squares, the shouts and the sound of tamborines of two troops of gymnastic mountebanks, installed at opposite corners, are heard above the voices, songs, and clatter of implements of labor in the surrounding workshops. One of these troops performs in the open air, its heroes being the swallower of swords, and the prodigious jumper. The latter leaps with impunity through two hoops crossed at right angles, fixed on the top of a pole, which also supports a jar carefully balanced on the intersecting hoops. But his most remarkable feat consists in leaping, or rather flying, from end to end through a cylinder of bamboo lattice work six feet long and placed on trestles. When he wishes to excite the amazement of the spectators to the highest pitch, the performer lights candles and places them in a line, at regular intervals, in the interior, of the cylinder; after which he passes through like a flash without extinguishing or deranging them.

"His gentle spouse, seated on a box beside the cylinder, accompanies the different stages of the performance with airs on her guitar. To the shrill sounds of the instrument she adds, from time to time, the tones of a voice which is either hoarse and hollow, or piercingly elevated, according as she judges it better to encourage sternly or to celebrate triumphantly the prowess of the astonishing man whose fortunes she is permitted to share."

### Electromagnetic Burglar Proof Curtain.

This invention consists in the arrangement of a burglar proof curtain to be suspended in front of safes, vaults, behind windows, or in other suitable places, and connected with an electric alarm apparatus in such a manner that it will, when moved or pierced, cause the alarm to be sounded.

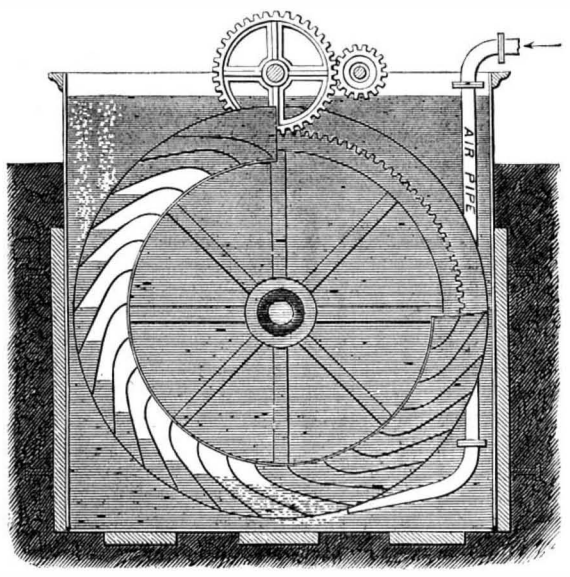
By the use of such curtain a very cheap and, it is claimed, most effective guard is obtained, which can, over night, be suspended in front of the things or openings to be protected, while during day time it can be rolled up out of the way or otherwise do the service of ordinary curtains.

Any attempt to enter by cutting through the curtain will cause an alarm to be sounded by the establishment of a complete circuit, while, on the other hand, any attempt to roll up the curtain or lift the roller from the brackets will, by entirely breaking the circuit, also cause an alarm to be sounded.

Messrs. Edwin Holmes, of Brooklyn, N. Y., and H. C. Roome, of Jersey City, N. J., are the inventors.

### CALLES' HYDRO-AERO-DYNAMIC WHEEL.

A mode of transmitting power to great distances, proposed by an exhibitor at the Paris Exposition, from Belgium, Mr. A. Calles, makes use of air under a certain degree of compression as the vehicle of the force to be transmitted, not by accumulating the air thus employed in reservoirs, but by driving it, by the operation of the original motor, directly into a tube extending to the point of final application, where it is to be discharged beneath a wheel submerged in water, which it is to turn by its ascensional force. The mode of application is illustrated in the accompanying engraving, and is described as follows in Dr. A. P. Barnard's report on machinery and processes:




The idea of employing compressed air as a means of transmitting power is not new; but the mode here suggested of using the power so transmitted is sufficiently original. The exhibitor claims originality in another point of view. His application of the power is not only original in form but in principle also. At Mont Cenis, where air is employed as a vehicle of force, it is the elasticity of the compressed air which furnishes the motive power. Consequently, it is there important that the compression should be carried very far. It is carried, in fact, up to six atmospheres. The present apparatus proposes to derive its mechanical advantage not from elasticity, but from volume. It is, therefore, here equally important that there should be as little compression as is compatible with the attainment of the object.

The air being employed to turn a submerged wheel, it will be easily understood that the wheel must have the form of an ordinary overshot water wheel reversed. In the overshot wheel, it is the weight of water, which is in the buckets of the descending side while those of the ascending side are empty, which causes the wheel to turn. The motive power is the difference between the counteracting weights of the two sides. In the submerged wheel driven by air, on the contrary, it is the weight of water which is displaced from the buckets of the ascending side, while those of the descending side are full, which is the measure of the driving power. In the present case, as in the former, this driving power is the difference between the weights of the two sides.

It is assumed by the inventor that air immerged in water ascends to the surface with a velocity of one meter per second. In point of fact, the rapidity of ascent of air in water will depend very much upon the volume ascending, and will be, on an average, materially greater than is here stated. But assuming the statement to be correct, it would furnish a limit to the velocity which can be given to the circumference of the wheel; and a given wheel will perform its maximum of work when the supply of air is sufficient to keep its ascending buckets full at half this velocity. Considering, however, that the motive power in the case is gravity, the most advantageous velocity must be necessarily not greatly different from that which experience has shown to be best with the ordinary overshot wheel working in the air—that is to say, must not exceed one meter per second at the circumference.

The compression of the air must evidently be sufficient to overcome the pressure of the water at the point of efflux beneath the wheel. This point may be taken at three or four meters of depth, and the corresponding pressure will amount to three or four tenths of an atmosphere. As the air ascends, it resumes by degrees the bulk which belonged to it before compression. In order to take advantage of this circumstance, the velocity of discharge must be so adjusted to that of the wheel that the buckets may not be entirely filled at the bottom. Otherwise there will be an overflow from the rising buckets, and to that extent a loss of motive power.

The inventor takes no account of the resistance of tubes to the flow of air through them. He supposes that at low pressures and low velocities this resistance will be insensible, so that the power received from the source may be almost wholly re-established by the wheel. He has erected a wheel in the park of the Exposition, which is designed to demonstrate the truth of this proposition, and to illustrate his system generally. It is driven by air compressed by an engine in the palace, and transmitted through a tube nine and a half centimeters ($3\frac{3}{4}$ inches) in diameter, and one hundred and fifty-seven meters (more than 500 feet) in length. This tube makes in its course fourteen right angles in order to avoid the constructions which it encounters on its way. It is computed that a force of nine and a half horse power is expended in compressing the air, and that the velocity of efflux is thirty-two meters (more than 100 feet) per second. On the other hand, the power of the wheel turned by the escaping air is stated at nine horse power. From these figures it would result that the loss in the present instance is but about five per cent. That there is a fallacy in the calculation is evident from the consideration that the loss of a submerged wheel, driven in this way by air, cannot be less than that of an ordinary overshot water wheel of the same dimensions; and that this loss is at least one fifth, and is often more than one third. And it results from the experiments of the Italian engineers at Coscia, on the resistance of tubes to columns of air driven through them, that to maintain such a velocity as is stated to be given to the air in this experiment, and to the distance named of one hundred and fifty-seven meters, there would be required an expenditure of force without return, sufficient to produce a compression of nearly an atmosphere and a half.

### Locomotive and Traction Engines.

Thomas Aveling, of Rochester, England, well known in connection with the celebrated Aveling & Porter's steam road rollers and traction engines, has just patented, through the Scientific American Patent Agency, an improvement the object of which is to construct agricultural, road, traction, and portable steam engines, and tramway locomotives, in a simpler and more economical manner than heretofore, and at the same time to render them stronger and more durable.

At each side of the fire box end of the boiler is fixed a strong wrought iron horn plate. These horn plates are riveted to the boiler and firebox. They project beyond the end of the fire box, and above the top of the boiler. The projecting portions of the horn plates are connected to the crown of the boiler by curved or bent plates, between which and the horn plates are secured the bearings for the crank-shaft. The axle of the traveling wheels works in bushes secured in screw bolts to the rear ends of the horn plates. Above this axle is a shaft, also working in bushes and carried by the horn plates. To this shaft is keyed the gearing for transmitting the rotary motion of the crank shaft to the axle of the traveling wheels. The crank shaft receives rotary motion in the usual manner from the cross head and connecting rod of the engine, and is fitted at one end with a spur pinion which drives intermediate gearing; and, through the spur wheel, gives rotary motion to the axle of the traveling wheels. A fly wheel, on the opposite end of the shaft, is employed to carry the crank shaft over its dead points. The engine is fitted, as usual, with a tank, and it is provided with any approved steering apparatus for guiding the front wheels.

From the above description, it will be understood that as the wrought iron horn plates will take all the thrust from the piston acting on the crank shaft the boiler and fire box will not be so liable as heretofore to be damaged or strained by the working of the machinery.

### Resistance of Nickel to the Action of Water.

A small square bar of steel coated with nickel has been repeatedly immersed in water for hours together without showing any signs of rusting, and Mr. John Spiller states, in the *Photographic News*, that he finds it possible to bury it in flowers of sulphur for several days without tarnishing the lustre of the nickel surface. Neither has this latter severe test any effect upon the copper and brass bars upon which the nickel coating has been applied, and these metals may even be immersed in aqueous solution of nitrate of silver without effecting the reduction of that metal. In one of the angles only, where the coating seemed to be imperfect, was there any indication of silver reduction in the case of the brass tube, the steel bar being perfectly protected over the whole surface against the action of silver and copper solutions.

Here, then, is a most valuable property in electro-deposited nickel. A metal of the zinc and iron group is proof against the action of nitrate of silver; the experiment proves it to be so, and we must regard pure nickel as belonging (from this point of view) to the class of noble metals, resisting, like gold and platinum, the attacks of sulphur and of highly corrosive metallic solutions. The nickel facing, when burnished, has a whiter color than polished steel, although not equal to silver itself, its aspect being rather that of rolled platinum. It withstands the action of heat also remarkably well, for the fusion point is very high, and oxidation occurs only at elevated temperatures. For fine balance beams and weights, lens mountings, reflectors, laboratory microscopes, Sykes' hydrometers, still worms, egg beaters, camera fittings, and a variety of apparatus used by the chemist and photographer, the nickel coating will, probably, find extensive application.

THE steamer *New London*, recently burnt in Long Island Sound, is reported to have been scandalously ill furnished with appliances for subduing fire and for saving life. "The life preservers and the boats were inaccessible, and the people on board the steamer had to make their escape as best they could, throwing planks and state room doors into the water, and then leaping after them in hopes of reaching shore by their friendly aid. The fire extinguishing apparatus, too, could not be promptly and effectually used." The *Commercial Advertiser* thus accounts for a calamity in which at least twenty persons lost ther lives.

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### Improved Safety Water Gage.

It is needless for us to say anything in regard to the value of a reliable water gage as an adjunct to steam boilers. The gage shown in our engraving, however, has certain peculiarities of construction not to be found on ordinary water gages, which improvements render it perhaps better adapted to general use than any hitherto brought before the public.

It is called the "Safety Water Gage" from the fact that if, as frequently occurs, the glass tube should be broken, the escape of water and steam is prevented by the action of valves which automatically close the communication between the boiler and the tube.

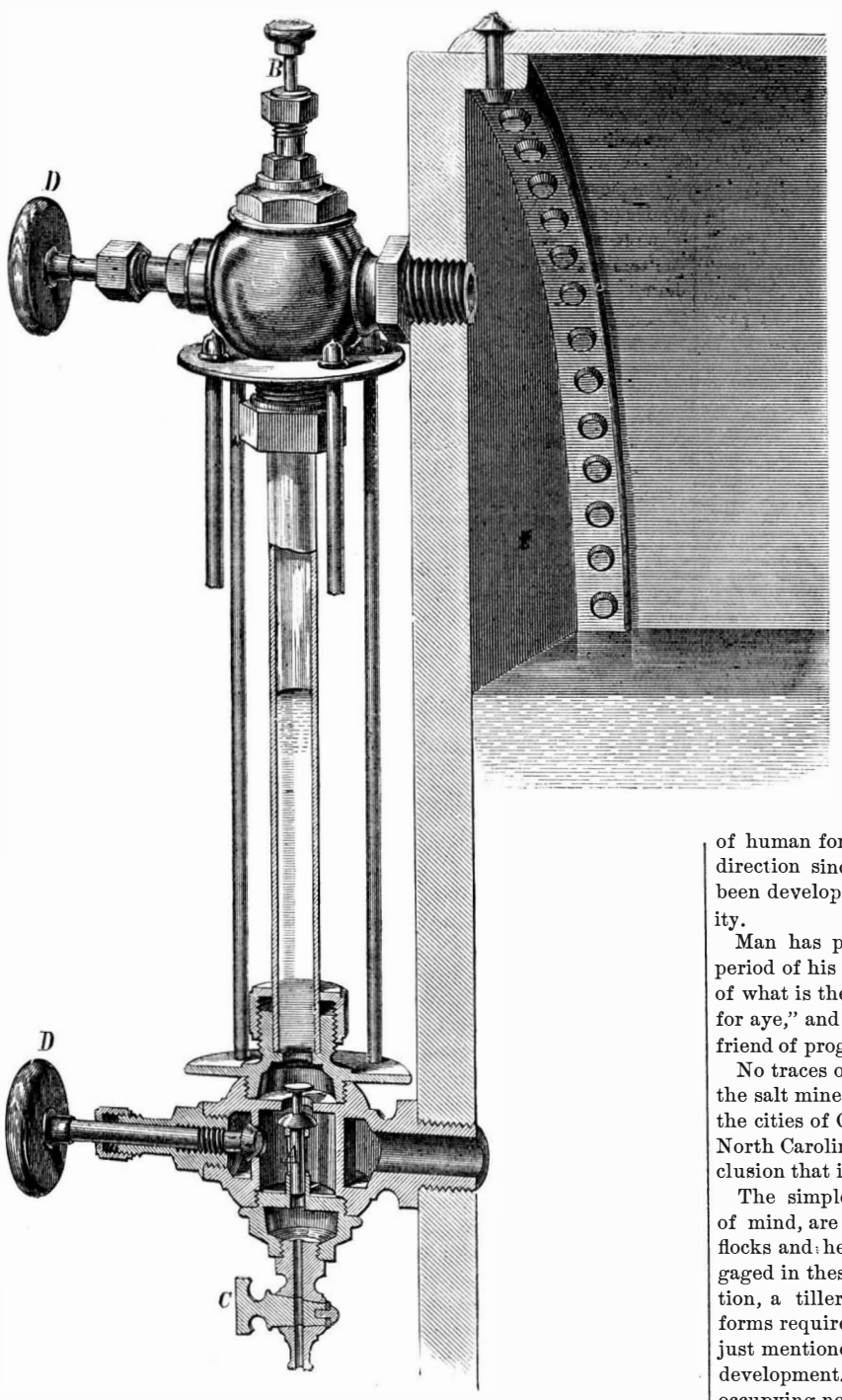
The method by which this is accomplished is indicated in the engraving, where A represents the lower valve, B the knob on the stem of the upper valve, C a pet cock for keeping the gage free from sediment, and D hand knobs on the stems of valves which control the passage of steam and water from the boiler, but do not act automatically.

As will be seen, the lower valve, A, receives the pressure of water upon its under side, so that if the pressure upon its upper surface be removed by breaking the tube, the valve is immediately forced up to its seat, thus preventing the outflow.

The upper valve attached to the stem, B, is of the same form, and prevents the efflux of steam in the same manner, the passage of the steam being out, through the upper cock which connects boiler and gage, into a chamber, thence up through the valve attached to B, and down through an annular passage to the glass tube. It is evident that the moment the pressure in the glass ceases, these valves will immediately close.

A very great advantage is obtained by this construction, namely, that the cocks connecting the gage and boiler may be made so large as to obviate all danger of clogging, without the danger of any one getting scalded or burnt, should the glass tube break. The gage is therefore not only safe in its action, but much more reliable in its indications than the old form of gage.

When it becomes necessary to put in a new tube, all that is required to set the gage in operation after its attachment is to press down the knob, B. This first lets steam into the tube; the pressure then being equalized on the top and bottom of the valve, A, the latter drops and allows the water to rise to its proper level. In order that the valve areas above and below, which receive the pressure, shall be equal, the valves are given conical faces, which meet the sharp edges of the port, as shown in the lower valve, at A. Several hundred of these gages are in use and giving great satisfaction. Patented June 11, 1867. For further information address the manufacturer, Augustus P. Brown, 57 Lewis street, New York.




BROWN'S PATENT SAFETY WATER GAGE.

### Cook's Evaporating Apparatus.

Mr. Justus Cook, of Wellsville, N. Y., has nvented a new evaporating apparatus for the convenient and economical heating and evaporating of liquids in the process of extracting the juices of plants, roots, barks, etc., as well as in the manufacture of sirups and sugar. It consists in an evaporating vessel with a flat bottom and circular or square ends, and with a false flat bottom so placed as to leave a steam space between the true and false bottoms, and in one or more rotating agitators or stirrers.

Between the true bottom and the false bottom, the steam is introduced, and made to pass back and forth beneath the liquid in the vessel. Timbers beneath the vessel, on each side, are made adjustable by means of a joint connection and a screw for each pair of timbers, by means of which the vessel may be brought to a true level, and the liquid properly distributed or discharged. The agitators or stirrers are attached to vertical shafts, and suspended from transverse trusses. The latter are supported by the sides of the vessel.

When the evaporating vessel is full or nearly full, the stirrers will revolve beneath the surface of the liquid and keep the liquid in a constant state of agitation. Sweep plates, attached to the vertical shafts, stand edgewise above the heads of the agitators. These plates are designed to fan the surface of the liquid and blow off the steam to increase the evaporation.

As the heating agent employed for this evaporation is steam, the vessel may be made of wood, and also the lower or true bottom. The false bottom is made of metal, on account of its being a better conductor of heat.

### Pierson's Frames for Diking Sheets.

This invention furnishes an improved frame for diking sheets, which enables them to be handled, transported, and placed or driven without danger of breakage, thus removing one great source of expense in using diking sheets.

The diking sheet may be made of metal, cement, or other suitable material or combination of materials. These sheets are designed to be driven into the ground where the dike is to be formed, and should extend from about six inches below the low water line to about six inches above the high water line, to prevent rats, crawfish, etc., from working through the dike.

As heretofore made, many of the sheets, even when made of metal, are broken in the operation of driving, and very many, especially when made of composition, are broken by handling and transportation, thus entailing great loss. To prevent this loss, a frame is put upon the sheets, the bottom bar of which is preferably made wedge shaped upon its lower edge, so that it may more readily be forced into the ground. The top bar of the frame rests upon the top edge of the sheet, and should be sufficiently strong and heavy to allow the sheet to be driven without being broken. The side bars of the frame cover the sides of the edges of the sheets, and the ends of these side bars are attached to the opposite sides of the ends of the top and bottom bars, so that the edges of the sheet may be flush with the outer edges of the side bar. This construction allows the adjacent edges of the sheets, when arranged in place, to be in contact with each other, so that there may be no space between the sheets when the frames may decay or be removed. The frames may be made of wood or metal, and permanently attached to the sheets. Or, if desired, the frames may be so made and attached to the sheets that they may be detached and removed, in whole or in part, after the sheets have been driven to their places.

Mr. James S. Pierson, of New York city, is the patentee of this improvement.

### Indian Cotton Cloth.

The marvelous delicacy of touch possessed by the Indian women (says an English writer) counterbalances the inferiority of Indian cotton in weaving the fine and delicate muslins to which the names of "webs of woven air," "dew of night," "running waters," etc., are given by the natives. They now use the spinning wheel generally for the ordinary fabrics, but "the spindle still holds its place in the hands of the Hindoo woman when employed in spinning thread for the finer muslins. For these the Hindoo woman first cards her cotton with the jawbone of the *boalee* fish; she then separates the seeds by means of a small iron roller, worked backwards and forwards upon a flat board. An equally small bow is used for bringing it to the state of a downy fleece, which is made up into small rolls, to be held in the hand during the process of spinning. The apparatus required for this consists of a delicate iron spindle, having a small ball of clay attached to it in order to give it sufficient weight in turning, and imbedded in a little clay there is a piece of hard shell, on which the spindle turns with the least degree of friction."

Very great attention is paid to the temperature of the air during the process of spinning, and the spinners in the dry climate of the Northwest of India work underground to secure a moist and uniform atmosphere. The cheapness of English manufactured goods seems to have greatly depressed the cotton fabrics of India, but the fine muslins of the latter country yet maintain undisputed celebrity, and are valued as highly as ever. The Dacca muslins are the very finest of all. One of the best pieces which found its way to England was ten yards long by one yard wide, weighed only three ounces two pennyweights, and could be passed through a very small ring.

### Improvement in Architecture.

The earliest periods were characterized by the utmost simplicity of invention and construction. Later, the efforts for defence from enemies and for architectural display, which have always employed so much time and power, began to be made. The megalithic period has left traces over much of the earth. The great masses of stone piled on each other in the simplest form in Southern India, and the circles of stones planted on end in England at Stonehenge and Abury, and in Peru at Sillustani, are relics of that period. More complex are the great Himyaritic walls of Arabia, the works of the ancestors of the Phœnicians in Asia Minor, and the Titanic workmanship of the Pelasgi in Greece and Italy. In the iron age, we find granitic hills shaped or excavated into temples; as, for example, everywhere in Southern India. Near Madura the circumference of an acropolis like hill is cut into a series of statues in high relief, of sixty feet in elevation.

Easter Island, composed of two volcanic cones one thousand miles from the west coast of South America, in the bosom of the Pacific, possesses several colossi cut from the intrusive basalt, some in high relief on the face of the rock, others in detached blocks removed by human art from their original positions and brought nearer the sea shore.

Finally, at a more advanced stage, the more ornate and complex structures of Central America, of Cambodia, Nineveh, and Egypt, represent the period of greatest display of architectural expenditure. The same amount of human force has perhaps never been expended in this direction since, though higher conceptions of beauty have been developed in architecture with increasing intellectuality.

Man has passed through the block and brick building period of his boyhood, and should rise to higher conceptions of what is the true disposition of power for "him who builds for aye," and learn that "spectacle" is often the unwilling friend of progress.

No traces of metallic implements have ever been found in the salt mines of Armenia, the turquoise quarries in Arabia, the cities of Central America, or the excavations for mica in North Carolina, while the direct evidence points to the conclusion that in those places flint was exclusively used.

The simplest occupations, as requiring the least exercise of mind, are the pursuit of the chase and the tending of flocks and herds. Accordingly, we find our first parents engaged in these occupations. Cain, we are told, was in addition, a tiller of the ground. Agriculture in its simplest forms requires but little more intelligence than the pursuits just mentioned, though no employment is capable of higher development. If we look at the savage nations at present occupying nearly half the land surface of the earth, we shall find many examples of the former industrial condition of our race preserved to the present day. Many of them had no knowledge of the use of metals until they obtained it from civilized men who visited them, while their pursuits were and are those of the chase, tending domestic animals, and rudimental agriculture.—*Professor E. D. Cope, in Half Hours with Modern Scientists.*

### Goodrich's Improvement in the Manufacture of Iron.

This improvement in the process of puddling and boiling and smelting iron ores, and melting iron, is especially adapted to the manufacture of wrought iron from the ore in the processes of puddling and boiling. It consists in the use of agglomerate balls or masses, composed of ingredients hereinafter described, and used in combination with the iron or iron ore; the temperature of the furnace and the circulation of the blast being, in a great measure, controlled by the size and quantity of the agglomerate balls; and the effect produced upon the ores and iron treated being, in a great measure, dependent upon the proportions of the ingredients of which the balls or masses are formed.

The chemical character of the different iron ores varies so much that the true proportions of the ingredients of which the agglomerate balls are formed can be ascertained only by experiment. This the metallurgist can readily ascertain in working the ore or smelting and melting iron. Diffe rent ores melt at different degrees of heat and require different quantities and kinds of flux. The flux being one of the ingredients of the agglomerate balls, the quantity and kind of flux must be varied to properly flux each particular kind of ore.

The invention combines, into hard balls or masses of any desired form and size, iron ore reduced to a granulated state or to a sufficient degree of fineness, pulverized coal or carbon, and lime or other flux. Gum or gluten of any kind may be added to produce sufficient cohesion in the mass. The entire quantity of ore used in the furnace may (in combination with

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carbon and the proper flux) be formed into these ball or masses; or the balls thus formed may be used in combination with ores in puddling, melting, or smelting.

He claims that by thus combining, with the ore, carbon and the proper kind and quantity of flux in the deoxidizing and carbonizing of ores, he overcomes obstacles which have hitherto been considered insuperable.

The balls are composed of seventy-five parts of iron ore: twenty parts carbon; three parts slaked lime; one part nitrate soda; and one part molasses. The ore, carbon, and lime are mixed intimately together, and the molasses and nitrate of soda dissolved in water enough to form the whole into a mass, which is then formed into balls and dried in the sun. This is about an average proportion, which, as before said, varies with different ores. The object is to avoid the melting point in carbonizing, but to go as near it as possible. He thus charges the ore as highly with carbon as possible, before it reaches the melting point. For puddling, he uses say eighty parts burnt iron ore made very fine; sixteen parts carbon; two parts slaked lime; one fourth part nitrate soda; and one and three fourths parts of molasses; mixes the ore, carbon, and lime minutely, dissolves the molasses and nitrate soda in water enough to mix, and then forms the mass into balls and dries them. For melting iron ore, he uses seventy parts ground carbon; three fourths part lime; one fourth part nitrate of soda; twenty-eight parts finely ground ore; and one part molasses. For smelting iron ore, sixty-eight parts ground and burnt iron ore; twenty-five parts carbon; five parts lime; one part nitrate soda; and one part molasses.

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Psychic Force.

*To the Editor of the Scientific American:*

Under this head I will introduce to your notice an experiment, which is akin to or identical with the power possessed by Mr. Home, and which experiment can be tried by any person for himself in less than five minutes.

A slip of thin writing paper, one and a half inches in length and a quarter of an inch broad, is creased in its middle, lengthwise and crosswise. This makes a dipping of the two ends, by which it may be poised on a needle point. The needle is set perpendicularly in a piece of cork, this forming a stand or support.

Now hold the hand, curved to the form of the quarter arc of a circle, near to the outer circle to be described by the paper arrow, and this will move circularly, not always immediately, for sometimes you may have to wait several minutes. For some persons, it will revolve over a hundred times per minute. In most instances it revolves towards the tips of the fingers, but not always. By putting the other hand near, in such manner as to point the fingers in the same circular direction the motion is generally increased. *Voila!* Try it and study its mystery!

"Heat!" is the first exclamation of many; but if it were caused by an upward current of air, the direction of revolution would be determined by the pitch of the ends of the arrow. Experiment has proved that pitching the ends propellerwise has no effect; and reversing the pitch does not change the direction of motion.

Gentlemen of the other side, I charge that if I were to announce that very few persons could do the above, you would cry "deception," "delusion," "weak minded," etc. But, the experiment being within the reach of all, there will be no such rejoinders as Professor Crookes has been annoyed with. In this experiment, the requirements pointed out by the Editors of the SCIENTIFIC AMERICAN are also met, and it may prove to be an anticipation of the delicate apparatus to be devised by Professor Crookes, showing that all persons are more or less possessed of this power.

J. A. SOLLIDAY.

Philadelphia, Pa.

[We tried this experiment, which our correspondent affirms will always succeed, but we had not enough psychic force to make the paper turn, except when we blew it. Perhaps some of our readers are better endowed.—EDS.

### Railroad Gages.

*To the Editor of the Scientific American:*

I have felt for some time that the thanks of the engineering profession are due to the SCIENTIFIC AMERICAN, for the timely and efficient effort it has made to anticipate and prevent the error into which capitalists are likely to be led on the subject of railway gages reduced below the ordinary 4 feet 8½ track. I am glad to see that an engineer of Colonel Seymour's experience has spoken emphatically on this subject.

The necessity of uniformity in such a country as ours ought to supersede any ordinary questions of detail; and it would be a very great advantage to the railway interest of the United States if our engineers would agree, with one consent, to hold to the gage which has come to us from the old country, and which practically meets the problem of railway operation as well as can be desired. In fact, it would be well if this gage question, like that of standard weights and measures, could be made a matter of Congressional law, so as to relieve us from the continued confusions and embarrassments resulting from the want of a common standard. The arguments advanced in favor of a narrower gage are fallacious, as the arguments in favor of an increase have proved to be by much experience and very great outlay; and while there are times when engineers and scientific authorities need to advance far beyond the current of popular sympathy, there are other occasions when a conservative and guarded course is equally essential; and a popular paper deserves commendation and endorsement as much in one case as in the other.

SAMUEL MCELROY

Brooklyn, N. Y.

[For the Scientific American.]

### ON SPECIFIC HEAT.

BY P. H. VANDER WEYDE.

The adoption of a unit of heat (explained on page 356, of the last number of the SCIENTIFIC AMERICAN), has given occasion to the correct investigation of different classes of phenomena, formerly not well understood; one of these is the peculiar property, of different substances, of requiring different amounts of heat in order to be heated to the same temperature. These amounts differ whether we take the equal quantities of the different substances by weight or by volume. They are of course measured by the accepted standard; the unit and the numbers representing these amounts (accepting that of water as 1) are called the specific heat of the substance, even as the weight of equal volumes of different bodies (accepting water as 1) is called the specific weight. Thus it was found that the amount of heat sufficient to raise the temperature of one pound of water a certain number of degrees was equal to the amount required to raise to the same temperature not less than thirty pounds of mercury, a mass of mercury more than twice the volume of a pound of water, because mercury is only 13·5 times heavier. It was further found that 31 lbs. of gold, 17 of silver, 10·5 of copper, 8·75 of iron, and 5 of sulphur, contained respectively as much heat as 1 lb. of water; or, in other words, required the same amount of heat to raise their temperatures to the same degree. We must, then, necessarily conclude that, at the same temperature, water contains 30 times as much heat as mercury, 31 times as much as gold, 17 times as much as silver, 10·5 times as much as copper, 8·75 times as much as iron, and 5 times as much as sulphur.

Consequently it is easy to deduce from this, when dividing 1,000 by the above numbers, that when water contains 1,000 units, mercury will contain $1{,}000 \div 30 = 33$, gold $1{,}000 \div 31 = 32$, silver $1{,}000 \div 17 = 57$, copper $1{,}000 \div 10{\cdot}5 = 95$, iron $1{,}000 \div 8{\cdot}75 = 1{\cdot}14$, and sulphur $1{,}000 \div 5 = 200$; or, by taking water = 1, their numbers become, respectively, for mercury 0·033, gold 0·032, silver 0·057, copper 0·095, iron 0·11, and sulphur 0·2. These numbers, then, are called the specific heat of the substances.

Different methods may be employed to determine this specific heat. One is the melting of ice by a certain amount of the substance (after having heated the latter to a certain definite degree of heat), and to compare the amount of ice thus melted with that melted by an equal weight of water, heated to the same temperature as the substance in question. Of course peculiar precautions are necessary in order to prevent the ice from being melted by exterior causes other than the heat of the heated body under investigation. Another method is that of mixture. It consists in raising the substance to a certain definite temperature, and then throwing it into a vessel containing an equal weight of water at another definite low temperature. The amount of heat communicated to the water will be proportional to the specific heat of the substance. Suppose, for instance, we mix one pound of water at a temperature of 156°, with another pound of water at a temperature of 32°, we shall find that the temperature of the mixture will be the mean, or 94°. But when we mix one lb. of mercury of 156° of temperature with one lb. of water at 32°, the temperature of the mixture will only be 36°. The water, therefore, will have gained only 4 units of heat, in compensation for the 120° lost by the mercury. It is evident from this that the amount of heat required to raise the temperature of one lb. of mercury four degrees, is equal to one thirtieth of that required to effect the same result on water; or, in other words, one thirtieth of the adopted unit of heat. This experiment becomes still more striking if we take equal quantities in bulk of both these substances. Suppose we take a pint of water of 32°, and a pint of mercury of 156°, and mix them; the temperature of the mixture, in place of being the mean or 94°, as is the case when mixing equal volumes of water, will only be 69°. The water has gained only 37°, in compensation for 87° lost by the mercury It is clear from this, that the amount of heat required to raise the temperature of one pint of mercury 37°, is equal to about two and one third of that required to produce the same effect on a pint of water, notwithstanding that the pint of mercury is more than thirteen and one half times heavier than the pint of water; in fact, three pints of water contain as much heat as seven pints of mercury, notwithstanding the latter surpasses the first some thirty times in weight.

The heavier metals have almost all very nearly the same specific heat as mercury. Thus, lead = 0·031; iridium, 0·032; osmium, 0·031; platinum and gold, 0·032; thallium, 0·034; bismuth, 0·031; tungsten, 0·033. However, in another class, the specific heats are nearly double the above numbers; thus palladium = 0·059; rhodium, 0·053; silver, 0·057; tin, 0·056; cadmium, 0·057. While, again, in another class, they are triple, or more than triple the first. Thus copper = 0·095, zinc, 0·096; cobalt, 0·1; nickel, 0·11; iron, 0·114. The light metals have the largest specific heat, but always far inferior to that of water, and most of them nearly equal to that of sulphur. Thus aluminum = 0·21; magnesium, 0·25; sodium, 0·20; potassium, 0·16. The two latter are so light that they float on water, while the lightest of all metals, lithium, has the greatest specific heat, namely 0·94, almost that of water. In fact water has a greater specific heat than any other substance, perhaps a few solutions excepted. For instance, a solution of cane sugar has a specific heat of nearly 1·1.

This shows what an immense store of heat may be contained in the waters of our planet, especially the ocean, which covers about three fourths of its surface. If, then, we take into account that, for equal weights, the specific heat of air and gases is about one fourth that of water, and that our atmosphere has only the weight of a layer of water, at most, of 34 feet, it is clear that its heat is only equivalent to that of a layer of water of $34 \div 4$, or 8½ feet high. This depth of water, therefore, is capable of storing up as much heat as the whole atmosphere; and, in giving off its heat, is able to communicate half its excess of temperature to the air, retaining the other half. Suppose, for instance, a certain portion of the Atlantic ocean to have a temperature of 80°, while the atmosphere over it is 20°; eight and one half feet depth of water will then be capable of heating the air 30°, bringing it to 50°, while the water itself descends 30°, also reaching 50°. No wonder, therefore, that the Gulf Stream, which continually is pouring the warm water from the tropics against the northwestern coast of Europe and its islands, modifies the climate of this part of the world to such a degree as to make it much warmer than the regions in the same latitude on the continent of eastern Europe, Asia, or America. When we fully consider that water is about 800 times heavier than air at the ordinary pressure, it is clear that one cubic foot of water contains as much heat as $800 \times 4$, or 3,200 cubic feet of air, or one cubic inch of water nearly as much as two cubic feet of air.

In applying these facts to the heating of buildings, we must not, however, forget that the cold walls and objects in buildings require much more heat than the air (they have a greater specific heat), and therefore we cannot succeed in heating a room before we have brought all the objects in contact with the air to the same temperature. Applying this on a large scale again to the Gulf Stream, it is clear that west winds blowing over the same are heated to a moderate temperature, and will very soon lose this heat when passing, in winter, over the cold or perhaps frozen ground of the British Islands, France, Belgium, Holland, and the western parts of Germany In giving them a portion of their heat they will have lost most of it before reaching Russia; wherefore the influence of the Gulf Stream does not extend beyond the lands of western Europe, which enjoy the sole benefit of the same.

New York.

### SYRACUSE---ITS MECHANICAL INDUSTRIES.

A correspondent, in the New York *Daily Times*, gives a lengthy account of the mercantile and manufacturing industries of Syracuse, N. Y., from which we make the following extracts. In describing John Greenway's brewery, the writer says:

In this Syracuse brewery, looking, as it does, like some great orphan asylum or other State institution, the manufacture of beer is carried on, on so large a scale and with such mechanical precision as in itself to create more than a gastronomical interest. The first point is the wing of the building used for malting purposes. No less than twelve floors, each ninety-one by sixty-five feet, are used for the laying out of the malt for sprouting, after it has remained for forty-eight hours in the thirty-one steeping tubs, which hold 225 bushels apiece. The malt is in every stage of progress—some just taken from the water, some again almost ready for the drying kilns, where it is taken seven days after it leaves the tubs. There are two kilns to each floor. The kilns are heated by enormous furnaces, with twenty-four flues, in the basement. The flooring of the kiln is of iron, and the temperature, even on the top floor, is kept up to 90° Fahrenheit.

Malt is only made during eight months of the year, but in that time Mr. Greenway generally makes from 225,000 to 250,000 bushels. When the malt is properly dried it is transferred on a "carrier" to the storing bins below which hold about 45,000 bushels. These "carriers" are very ingenious contrivances. They run the whole length of the malt house and granaries, 335 feet, and communicate with the elevators and hoppers.

A "carrier" is a narrow endless sheet of cloth, about two feet in width and bagging slightly on the middle, which runs backward and forward on rollers moving on a staging four feet from the ground, and either discharges the malt into the hoppers, or carries the raw barley from the elevators to the malting rooms. It will carry 1,000 bushels an hour. The granaries consist of three floors, 162 feet long and 65 feet wide; two of them being 14 feet, and the third 11 feet high. They have a storage capacity of 175,000 bushels of barley. The hop room is 65 by 40 feet. Its contents vary in quantity, according to requirements and market values; but 350,000 pounds is about the average annual consumption.

"The two huge vats, in which the malt, hops and water are converted into beer, hold 300 barrels each. The fluid in them is boiled by a steam worm which covers the bottom and is fed from the boilers in the basement. All the beer is boiled by steam. One engine of forty-five horse power suffices for boiling the beer and heating the building in winter time. It consumes 700 tuns of bituminous coal in the course of the year. The coal bunkers of the establishment hold 300 tuns.

"An admirable contrivance, the patent of a Frenchman named Baudelot, is used for cooling the beer before it is run into the fermenting vats. The boiling beer is forced up to the floor above into a horizontal pipe seven feet from the ground. From this pipe it issues with great force from innumerable little jets, and dashes down on a succession of highly polished wooden bars about an inch in thickness and four inches across, placed like the laths of sun shutters when they are turned so as to admit the light. These bars are hollow, and are filled with constantly flowing iced water.

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The bars being polished and their edges rounded off, the beer always runs underneath and drops on the middle of the next one. Consequently, though very hot when it leaves the jets, it is quite cool when it reaches the trough at the bottom from which it is conducted through copper pipes to the fermenting vats. This apparatus will cool 120 barrels in an hour. By the way, there are nearly twenty miles of copper piping in the building.

"The foam caused by the fermentation of the beer, after the yeast has been mixed with it, assumes fantastic and even very beautiful shapes. Sometimes it resembles undulating slopes of smooth fresh snow; sometimes it works into masses like drifts of snow, and, again, it will assume the rugged, riven, appearance of a Swiss glacier. And, to add to the simile, there are constant avalanches of the foam in consequence of the continual escape of small quantities of the carbonic acid gas which sustains it.

"Six or eight inches above the suface of the foam, the gas is so powerful as to produce asphyxia in a very few seconds. Brewers have often lost their lives by carelessly inhaling it. Over the tun room, as it is called, there is an immense ice house, one of Brainerd's patent refrigerators, 150 feet by 11 feet, and 14 feet high. By a simple arrangement the cold strikes down, and in the hottest summer weather the beer is kept perfectly cool. The store rooms, three in number, hold together 8,000 barrels of beer. Last year the brewery sent out 50,000 barrels of beer and 12,000 barrels of lager beer. It is a common occurrence for the firm to pay $300 or $400 in one day to the Government for stamps. The ale from this brewery is shipped to all parts of the State, more especially the central and western divisions.

"Adjoining Mr. Greenway's great brewery are the Syracuse Flour Mills, owned by J. W. Barker & Co. The mill, which is built of red brick, is 140 feet by 80 feet, and has five stories and a basement. It is run almost entirely by water power, though it is provided with an auxiliary engine of 100 horse power. Under an old lease, granted twenty-five or thirty years ago, the proprietors are empowered to use the surplus water of the Erie Canal for driving their machinery. A stone wall, built into the bank of the canal, at the hight established by law, prevents the use of the water when the canal is low. The engine has been in use for one month this fall, in consequence of the extensive dryness of the season, but previously it had only been used in the aggregate six weeks during the five years which have passed since its erection. The water, after driving the wheel passes through the mill and runs away into the Onondaga Creek. The granaries of the mill have a storage capacity of 80,000 bushels of wheat, and the nine run of stones grind about 1,400 bushels a day.

"The wheat is passed from the granaries to the grind stones on a "carrier" similar to that in use in Mr. Greenway's brewery. The flour falls from the stones into receptacles below, from which it is carried by elevators to the cleaning and winnowing floors. There it is passed through four revolving cylinders, one within the other, made of very fine hair sieve cloth. These cylinders are erected at a slight incline, so that the flour and impurities are constantly passing out of them; the flour to the stores over the packing room, the impurities to the waste room.

The flour is barreled by a very simple contrivance, called the "packer." From the stores above, a large pipe runs down to within about four feet of the ground, the bottom of which will just fit the top of a barrel. The barrel after being weighed, is placed on an iron stool and raised by machinery to the pipe. The filling machinery is then set in motion. A small governor, which can be regulated to any weight, detaches the barrel, by letting the stool fall till the bottom of the barrel is level with the floor, as soon as the required weight of flour is in it. At the same time it closes the mouth of the supply pipe. The barrels of flour are at once shipped, as the firm have always as many orders on hand as they can fill. They generally ship about four hundred barrels a day, and averaging ten months running throughout the year, sell from forty thousand to forty-five thousand barrels a year."

## REPORT OF EXPERIMENTS FOR TESTING THE RELATIVE VALUE OF LUBRICATING OILS.

BY A. H. VAN CLEVE.

An experimental shaft with journals seven inches long, six inches diameter, was carefully fitted to brass bearings, supported by cast iron frames secured to a suitable foundation. A spur wheel attached to the center of the experimental shaft was geared to a pinion wheel, on the center of a driving shaft, with its bearings also attached to the cast iron frames.

A set of scale beams, arranged to apply any required pressure (within their capacity) to the lower half of the brass bearings, were also accurately fitted to the cast iron frames and foundation. The experimental shaft was driven by a five horse power oscillating engine, at a given number of revolutions per minute, on each experiment.

The velocity was determined by a counter attached to the end of the shaft. The brass bearings of the experimental shaft were kept at an average of 96° Fahr., which was determined by thermometers, inserted through them to within three eighths inch of the journals. An oil cup was placed over each bearing, graduated to fractional parts of a gill. A thermometer, to determine the temperature of the oil when applied, was placed in each cup. The experiments proved that the consumption of oil varied with its temperature when applied. The quantity of oil applied per minute was varied at intervals, as was required to keep the bearings as near 100° Fahr. as possible, as abrasion of the metals took place when it rose above that point. The total consumption of oil, at the close of each experiment, was averaged with the number of hours occupied in making the experiment. The pressure upon the journals was varied, for each kind of oil, as was necessary to preserve the uniform temperature of 96° Fahr., at the required revolutions of the shaft per minute on each experiment.

Hence, the number of square feet of the journal's surface travelled per minute, the pounds pressure upon them, and the quantity of oil applied, determined the lubricating value of the oil. The method of applying the pressure by the scale beams accurately indicated the power consumed by the engine to keep the shaft in motion during the experiments with each kind of oil.

A second series of experiments was made. (See Table No. 2.)

A shaft, with journals 6 inches long and 2¾ inches diameter, was fitted in place of the 6 inches diameter and driven at a corresponding number of revolutions per minute, for the purpose of testing the value of car box oils.

The experiments on each shaft were conducted with the same care, with corresponding results.

### RESULTS.

The accompanying Table (No. 1.) exhibits the results of several tests, from which it will be seen that winter sperm oil, from three houses, sustained the heaviest pressure, and the best of them was taken as the initial of comparison for all others, and their per cent of lubricating value determined by it. The tests of mineral oils and mixtures of animal and fish oils with them would not sustain an equal pressure with the sperm, when equal quantities of the oil were applied, without rapidly increasing the temperature of the journals, and producing an abrasion of their surfaces.

The experiments, as shown by Table (No. 2.), on car box oils, with a shaft having bearings 2¾ inches diameter, by 6 inches long, also proved that when the pressure on the bearings was made equal with winter sperm, it required from 100 to 400 per cent increase of oil, to keep the temperature of the journals below 100° Fahr. In no instance could the pressure on the car shaft be raised to 8,000 pounds (with mineral oils), it being the average pressure on an axle of a loaded coal car. Hence, it is to be inferred that the expenditure of locomotive power, and the cost of repairs on all loaded trains, must be in ratio with the quality of lubricating material applied.

Experiments were made at varied velocities, (see Table No. 3.) with the same oils. The results proved that as the velocity was reduced the pressure could be increased, and the relative consumption of oil, applied at equal temperatures, was decreased in almost equal ratio.

The experiments were continued during a period of fourteen months, on the oils purchased for the Camden & Amboy Railroad Company's use; the following results are deemed sufficient for illnstration:

### TABLE No. 1.

*With Locomotive Axle Bearings, 6 in. diameter, 7 in. long.*

| KIND OF OIL, PURCHASED OF VARIOUS DEALERS. | Revolutions of shaft per min. | Pressure on Journals—pounds | Temperature of bearings—Fahrenheit | OIL. Applied per hour—gills. | OIL. Per cent of lubricating value less than Flanders winter sperm | TEMPERATURE FAHRENHEIT. Began to thicken | TEMPERATURE FAHRENHEIT. Too thick to run | TEMPERATURE FAHRENHEIT. Congealed at | Horse power of engine consumed by each experiment. |
|---|---|---|---|---|---|---|---|---|---|
| Winter Sperm | 131 | 7500 | 96° | .73 | 1.00 | 28° | 26° | 24° | 3.55 |
| Winter Sperm | 125 | 7500 | 98° | .68 | .04 | 30° | 28° | 27° | 3.39 |
| Winter Sperm | 128 | 7000 | 96° | .82 | .09 | 32° | 26° | 24° | 3.24 |
| Engine Oil | 130 | 6633 | 96° | .48 | .12 | 34° | 32° | 30° | 3.12 |
| Engine Oil | 130 | 6548 | 96° | .44 | .13 | 19° | 18° | 8° | 3.08 |
| ⅝ Winter Sperm, ⅛ Lard | 129 | 5600 | 97° | .86 | .26 | ... | ... | ... | 2.61 |
| ½ Winter Sperm, ½ Lard | 123 | 5260 | 97° | .84 | .31 | ... | ... | ... | 2.45 |
| ⅛ Winter Sperm, ⅝ Lard | 132 | 4500 | 96° | .76 | .40 | ... | ... | ... | 2.15 |
| Engine Oil | 131 | 4125 | 97° | .82 | .45 | ... | ... | ... | 1.91 |
| Mason's Sperm | 127 | 4264 | 97° | .71 | .45 | ... | ... | ... | 1.96 |
| Lard Oil | 129 | 4000 | 98° | .69 | .47 | ... | ... | ... | 1.86 |
| Engine Oil | 129 | 3844 | 97° | .81 | .50 | ... | ... | ... | 1.77 |
| Engine Oil | 129 | 3500 | 97° | .75 | .54 | ... | ... | ... | 1.62 |
| Engine Oil | 125 | 3471 | 97° | .72 | .56 | ... | ... | ... | 1.56 |
| Engine Oil No. 2 | 125 | 1458 | 97° | .68 | .81 | ... | ... | ... | .66 |
| Engine Oil | 124 | 753 | 96° | .73 | .90 | ... | ... | ... | .34 |
| Refined Mecca | 127 | 266 | 98° | .71 | .97 | ... | ... | ... | .12 |

### TABLE No. 2.

*With Car Axle Bearings, 2¾ in. diameter, 6 in. long.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Winter Sperm | 251 | 7000 | 95° | .25 | .09 | 28° | 26° | 21° | 3.18 |
| Car Box Oil | 237 | 4854 | 93° | .17 | .35 | 17° | 15° | 10° | 2.08 |
| Car Box Oil | 225 | 4684 | 96° | .15 | .40 | 31° | 24° | 13° | 1.91 |
| Car Box Oil No. 1 | 241 | 4014 | 96° | .16 | .44 | 20° | 18° | 17° | 1.75 |
| Car Box Oil No. 2 | 240 | 4171 | 95° | .15 | .43 | 13° | 10° | ... | 1.81 |
| Car Box Oil No. 3 | 245 | 4071 | 95° | .16 | .43 | 16° | 14° | 13° | 1.79 |
| Car Box Oil No. 4 | 242 | 2500 | 95° | .18 | .66 | 28° | 26° | 10° | 1.09 |
| Car Box Oil No. 5 | 243 | 4000 | 91° | .14 | .45 | 15° | 13° | 10° | 1.76 |

MINERAL

### TABLE No. 3.

*With Locomotive Axle, at different velocities.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Winter Sperm | 130 | 7000 | 97° | .40 | .... | ... | ... | ... | ... |
| Winter Sperm | 100 | 7200 | 94° | .26 | .... | ... | ... | ... | ... |
| Winter Sperm | 70 | 8000 | 94° | .18 | .... | ... | ... | ... | ... |
| Winter Sperm | 60 | 9800 | 94° | .14 | .... | ... | ... | ... | ... |
| Winter Sperm | 130 | 7000 | 98° | .36 | .... | ... | ... | ... | ... |
| Winter Sperm | 100 | 7500 | 96° | .25 | .... | ... | ... | ... | ... |
| Winter Sperm | 70 | 8000 | 91° | .19 | .... | ... | ... | ... | ... |
| Winter Sperm | 60 | 9500 | 90° | .10 | .... | ... | ... | ... | ... |
| Engine Oil | 130 | 6500 | 96° | .24 | .... | ... | ... | ... | ... |
| Engine Oil | 100 | 7500 | 96° | .18 | .... | ... | ... | ... | ... |
| Engine Oil | 70 | 8000 | 92° | .14 | .... | ... | ... | ... | ... |
| Engine Oil | 60 | 9500 | 87° | .05 | .... | ... | ... | ... | ... |
| Lard Oil | 130 | 4000 | 98° | .31 | .... | ... | ... | ... | ... |
| Lard Oil | 100 | 5000 | 95° | .18 | .... | ... | ... | ... | ... |
| Lard Oil | 70 | 5500 | 93° | .12 | .... | ... | ... | ... | ... |

### Rogers' Fire Kindlers--A Curious Invention.

Mr. Noah Rogers, of Thomasville, Georgia, has invented an automatic fire kindler, which is a curiosity in patented inventions. It is a machine so constructed as to enable the fire to be kindled by any one in another part of the house, and without getting out of bed.

A CORRESPONDENT of the *English Mechanic* suggests two new uses for india rubber. One is for springs for locks, especially on gates and in other places exposed to the weather; the other is for proportional measuring, and the mode of application for this purpose will be obvious to our readers.

### Scientific Lectures to the New York Young Men's Christian Association.

The second of the above named series was delivered on Tuesday, November 28th, by Professor Doremus, the subject under consideration being "Fire and its Treatment." In the course of the lecture, Professor Doremus said:

Fire is the most awful exhibition given to man of the potency of the Creator, its power, either for good or evil, being incalculable. Various have been the theories held at different times as to the nature of heat. Lord Bacon maintained it was a mode of motion; the same view was held by Sir Isaac Newton, and in our own time the theory has been revived by a number of eminent chemists, chief among them Mr. John Tyndall who has written a book in defence of its truth. Fire had been considered by the ancients to be one of the elements; but this is not maintained at the present day, and we are in a certain sense at sea as to its proper place in creation.

We frequently read of instances where the leaves of trees, rustled by the blast, ignite and produce terrible conflagrations, such as have lately occurred in Wisconsin and Michigan, where whole forests were destroyed from this simple cause. On the same principle a body, traveling with great velocity, coming in contact with an opposing force, produces fire—as, for instance, a projectile striking against the side of a ship will send forth sparks of flame. The popular theories, which will be intelligible to all, relative to the production of this element are easily explained. It is by chemical means that we are daily mastering all the difficulties of science, and among them this principle of fire. If carbon or charcoal be exposed to the air it can easily ignite, and in the same way soft. In one year the Metropolitan Gas Company lost $125,000 by the burning of their soft coal when exposed to the air and in the same time twenty-eight of the coal ships which left Liverpool were supposed from the same cause to have been lost. Another great cause of fire is electricity, which has been fearfully illustrated by the destruction of Chicago. The air is surcharged with the electric force, and in such weather as we have at present this can be easily proved. If a person who walks a distance a day like this comes into a warm room, and rubs his feet for a length of time on a carpet or rug, in a short time the electricity will penetrate to the very tips of his fingers, and a match applied to them will ignite a flame.

This theory explains such phenomena as we read about in the papers in connection with the destruction of Chicago. People who lived long distances from where the fire was raging, who had no idea of moving to a place of refuge, suddenly discovered their houses on fire in a manner that seemed inexplicable to them. The truth of the theory is easily explained. Great fires, such as that one, create a strong current of electric air, which travels over great distances, frequently firing a city in places widely apart. The knowledge of this principle should create a counter element to prevent such disasters, and it is believed chemistry is able, with its comparatively limited knowledge, to suggest one. Apart from this, some valuable hints are being thrown out by men of science relative to the building of our cities. The long narrow streets are, it is said, very dangerous in the presence of a fire, short, broad streets on the European plan being much safer and less exposed to the action of the flames. Some improvements might be made in our Fire Departments. It has been suggested that, instead of water being solely depended upon as an extinguisher, a reservoir should be provided in all our larger cities, filled with either carbonic or sulphurous acid, which would be much more efficacious than water if pipes were connected with the reservoirs, leading to our large establishments. In case of a fire breaking out at any time, the mere action of turning on a valve and filling the burning apartment with the gas would extinguish the flames. The same method could be employed on ships at sea, and the disasters that are now so frequent could be easily prevented and controlled.

### To Filter Alcohol.

The following method of filtering alcohol or its solutions is said, by the *Druggist's Circular*, to be very satisfactory, and to be used extensively in North Germany, where it constitutes one of the secrets of the trade. Clean, unsized paper (Swedish filtering paper is the best), is to be torn into shreds and stirred into the liquid to be clarified. The whole is then to be strained through a flannel bag, when the resulting liquid will be found to possess the utmost clearness and limpidity. A filter may also be made by spreading thin paper pulp evenly upon stretched flannel or woolen cloth. When dry, the cloth so coated will be found to give better results than the felts, etc., commonly employed as filters.

PROFANITY never did any man the least good. No man is richer, or happier, or wiser for it. It commends no one to any society. It is disgusting to the refined, abominable to the good, insulting to those with whom we associate, degrading to the mind, unprofitable, needless and injurious to society.

PUBLIC LIBRARY AT MONTREAL.—We learn with much pleasure that the Messrs. de St. Sulpice intend to open, at Montreal, a library where students can consult, gratuitously, works of art and science which are difficult to procure. Students in medicine and law especially, who are considerably hindered in their studies for want of books, will appreciate this liberality.—*Journal de L'Instruction Publique.*

GREATNESS lies not in being strong, but in the right use of strength.

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### Improved Pipe Leak Stopper.

This is a very practical invention, having for its object the stopping of leaks which frequently occur in metal pipes. In the use of steam, leaks in the pipes are of more or less frequent occurrence, sometimes owing to the bursting of the pipes from over pressure, and often in cold weather from the freezing of the condensed steam. The difficulty of making repairs, in such cases, has been a source of trouble to most users of steam. A leak in the supply pipe of a boiler or engine often causes the stoppage of a factory for hours. By use of this invention, the delays incident to such cases are avoided. This leak stopper can be put on in from two to three minutes, and it not only quickly but effectually closes the leak. If, when making general repairs, the old pipes are replaced by new ones, the stoppers can be saved to be used again, as they will last indefinitely. It is believed that a supply of these, kept on hand against times of need, will save many times their cost to any user of steam. For dye houses especially, where pipes corrode rapidly, they are invaluable. Hundreds of manufacturing corporations and manufacturers in New England have proved these facts during the last twelve months.

The device consists of an overlap, A, a piece of rubber packing, B, and clamps, C, to hold the overlap and packing firmly down upon the leak. The application is so obvious as to need no further description.

This invention was patented July 6, 1869, by Stephen Moore, of South Sudbury, Mass., who has assigned his right to himself and Homer Rogers, of the same place. The stoppers are manufactured and sold by James J. Walworth & Co., 1 Bath street, Boston, Mass., whom address for further information.

Fig. 1

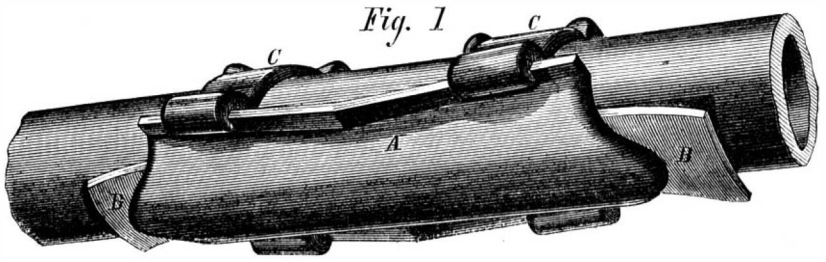
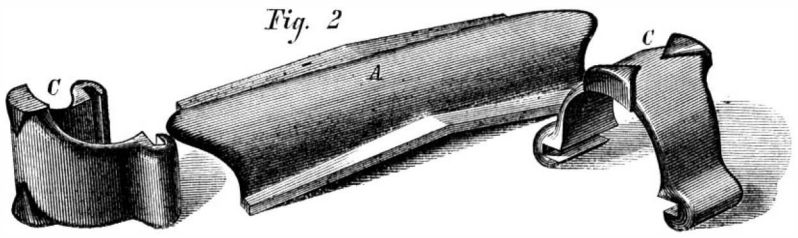


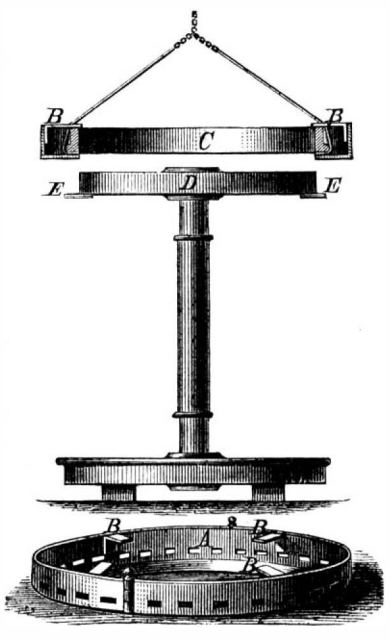

Fig. 2




MOORE'S PIPE LEAK STOPPER.

### SMITH'S PORTABLE FURNACE FOR SHRINKING ON TIRES.

We regard this invention as one of those practical, common sense improvements, meriting notice, not only on account of its simplicity and adaptation to the purpose designed, but because it is calculated to cheapen and render more perfect an operation that requires much exercise of judgment and care on the part of the workmen performing it. It also spares the workmen exposure to the intense heat to which they are subjected in the old method of setting tires.




Mr. William S. Henerey, of Meeting Street Foundery, Charleston, writes, in a letter to the inventor, as follows:

"To give an idea of its capacity, I will state that I saw a five feet tire, two and a half inches thick, hung in one of your furnaces, with shavings and kindling and one bushel of charcoal spread around it, and in 20 minutes from the time of lighting the fire the tire was set in position on the wheel. It is due to you to state that in this trial the work would have been done in three to five minutes less but for the haste of the workmen trying it on in thirteen minutes when the tire was not sufficiently expanded, thereby giving out heat to the wheel and causing a loss of at least three minutes to overcome this extra expansion, but at the same time clearly showing its great superiority over the old process, where the tire is taken out of the furnace; for instead of a disagreeable and troublesome failure, it only required to wait on the increasing heat for a few minutes to see it drop nicely into its place. I look upon its adoption as certain by all who have this class of railroad work to do, as it certainly is a great labor saving machine."

Mr. H. T. Peake, Superintendent of the South Carolina Railroad, says: "I would earnestly advise its adoption by all railroad companies, engine builders, etc."

Mr. E. F. Raworth, General Superintendent of the Vicksburg and Meridian Railroad Company, says, "the method is unquestionably superior to any now in use."

These testimonials from practical men show that the invention is worthy the attention of railway officials and builders of engines throughout the country, and their interest thus attracted will be hightened by the simplicity of the apparatus as it is shown in the accompanying engraving.

It consists of a fire box, A, made in halves, of No. 10 sheet iron, open at the top, and held together by hinge joints, so as to be easily separated. Brackets, B, are secured to the sides of the box, to rest on the top of the tire and support the box. Holes are punched around the sides and bottom of the box for the admission of air to the fuel (charcoal), which occupies the space of four inches around the tire.

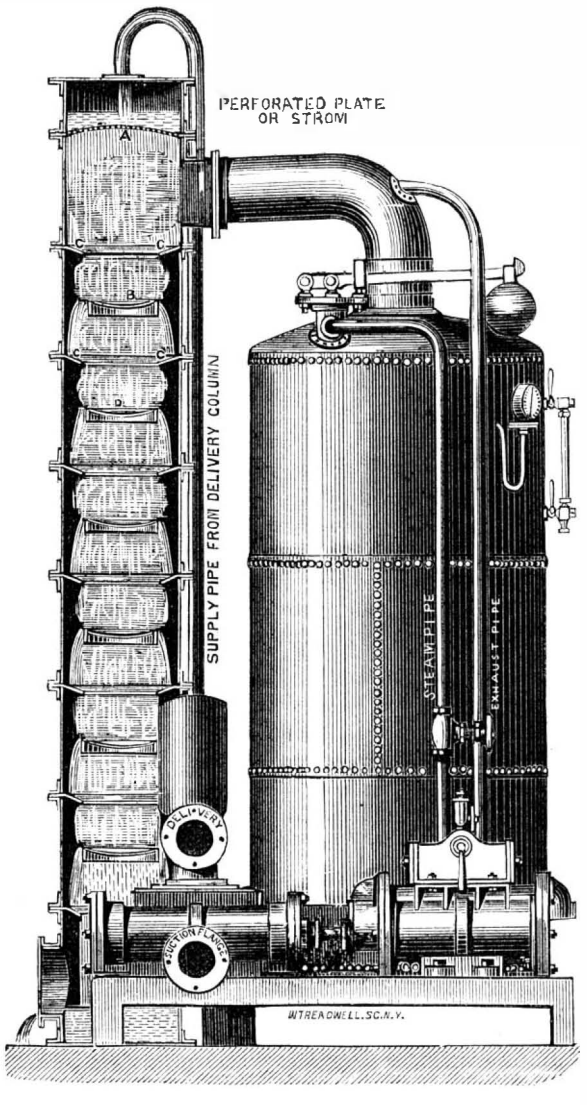
The tire, C, is suspended to a crane, the furnace then placed around it, and the charcoal put in and ignited. When the tire is sufficiently expanded (which may be readily determined by measuring with a rod), it is then placed on the wheel, D, resting on the gages, E; the furnace is then removed, the tire cooled off, and the unburned charcoal saved for the next operation. The furnace remaining around the tire until the operation is completed, obviates all danger of the tire sticking before reaching its destination.

It is claimed that one bushel of charcoal will shrink on any size tire, two and a half inches thick, with one sixteenth allowance for expansion, in less than thirty minutes from the lighting of the fire; and will remove an old tire in less than twenty minutes, not heating the wheel center sufficiently to injure the paint, and employing the labor of only four men.

For further particulars address the patentee, Mr. Wm. Bell Smith, M. S. C. R. R., Charleston, S. C.

### TANGYE'S SMOKE AND HEAT PRECIPITATOR.

The annexed engraving shows an apparatus manufactured by Messrs. Tangye Brothers and Rake, St. Nicholas' buildings, Newcastle-on-Tyne, for precipitating soot and smoke arising from steam boilers, etc., in coal mining and underground and confined operations, and also for condensing sulphurous and other fumes from copper and chemical works.




The principle of the invention is at once seen on reference to the sketch, and consists in leading the chimney of the boiler into the top of the vessel termed the "precipitator," immediately beneath a jet of cold water, taken from the delivery pipe of a pump, which is distributed over the area of the vessel by means of the "strum," A. The water, in falling, has the effect of reducing to a minimum the heat passing from the boiler, and, at the same time, precipitating and absorbing the particles of soot and other products of combustion. In cases where a large supply for the jet is available, the cups and saucers, B C D, are unnecessary and not used, the copious shower falling from the strum to the bottom of the precipitator being quite sufficient.

### IMPROVEMENT IN THE MANUFACTURE OF WHITE LEAD.

Mr. Decius Wadsworth, of Brooklyn, N. Y., has invented an improvement in the manufacture of white lead, for which he has recently obtained a patent through the Scientific American Patent Agency.

It is an improved arrangement of means for introducing and distributing the carbonic acid, used in the manufacture of white lead, in the basic solution of lead for precipitating, which consists in the application to the bottom of a tank containing a stirrer or agitator of one or more—preferably two—perforated pipes extending across the bottom in a groove or grooves, so that the stirrer or agitator will pass over them, the pipe or pipes extending through the side of the tank and being connected with a main pipe leading from the furnace in which the gas is generated, and having an air pump connected with it for forcing the gas into the solution in fine jets at intervals along the pipe, for exposing the whole mass uniformly to the action of the acid. The pipes are also arranged, at the projecting ends, to admit of the introduction of a brush or scraper from time to time, on the removal of a plug, for clearing them of the deposit of lead which enters the holes and obstructs the passage of the air and gas.

The tank is provided with a strong thick floor, in which are arranged two grooves, extending across it, one on each side of the center and parallel with each other. At one side of the tank are holes through it, coinciding with the grooves. These grooves are of suitable size to admit perforated tubes —say about three inches in diameter—so that they will not rise above the level of the floor. The tubes are arranged in the grooves, with one end projecting through the wall of the tank, and connecting with a supply pipe, which communicates with the furnace in which the gas is generated and has an air pump connection for forcing the gas into the tank through the small perforations. The agitator is kept in motion, while the acid is thus introduced, to thoroughly mix the acid with the solution. The pipes are connected with the main pipe in such a way that the outer ends, which are closed by plugs, may admit, when opened, a brush or scraper for removing the deposit of lead accumulating in them by settling in the holes. The pipes may be made of wood, copper, galvanized iron, or other suitable material.

By this improved means, the inventor claims to make the necessary uniform application of the acid to the lead with certainty and rapidity.

The process above described, namely, the distribution of carbonic acid over lead by means of a complicated arrangement of tanks, pipes, and other auxiliary parts, is old; but the improvement is intended to facilitate the operation and render it much more economical.

### Curtis' Improvement in the Manufacture of Gunpowder.

Mr. Charles William Curtis, of London, England, has invented and patented, through the Scientific American Patent Agency, an improvement in gunpowder for use in heavy ordnance, known as "pellet" powder, which is usually made by compressing meal powder in molds, whereby it is formed into pellets of cylindrical form. Mr. Curtis' improvement consists in splitting such pellets longitudinally into halves, forming grains of semicylindrical form, the result attained in use being claimed to be a higher velocity of the projectile without increasing the strain on the gun.

He takes unglazed pellet powder, or powder compressed into short cylinders or pellets, the manufacture of which is completed with the exception of the glazing and stoving processes, and subjects each pellet to the action of a knife or other instrument, operated by hand or otherwise, whereby the pellet is fractured or split in a longitudinal direction. The split pellets are afterward glazed and stoved in the ordinary manner, which completes the process of manufacture.

The pellets, when whole, instead of being cylindrical, may be of other form, cubes or parallelopipedes, for instance, according to the shape of the molds in which the meal powder is compressed, and the shape of the pellets when split will be varied accordingly, instead of being semicylindrical. In any case, each split pellet has one roughened or fractured surface, as above mentioned. The compression of the powder into pellets may be effected by the aid of any suitable machinery, as the present invention does not consist in the machinery for molding the powder, or in any particular construction of knife or other sharp or pointed instrument or machine for splitting the pellets, as any suitable instrument or machine may be employed for that purpose.

### The Boiler Experiments at Sandy Hook.

The experiments in the explosion of steam boilers under the authority of the United Railroad Companies of New Jersey, and the immediate direction of Mr. Francis B. Stevens, were commenced Nov. 22nd, on the U. S. Reservation at Sandy Hook. Nine boilers were set up and three were exploded under conditions which will form the subject of a future article. We prefer to defer a comprehensive review of the experiments until they have proceeded farther. The only important result yet reached seems to be the final corroboration of the fact, heretofore supported by much reliable testimony, that boilers may explode with terribly destructive violence, when amply supplied with water, and when the pressure is not in excess of that commonly used in high pressure engines.

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## SOMETHING ABOUT LUBRICATORS.

What is a lubricator? A common reply to this question would be "anything that has the power of reducing friction." But how these things act to reduce friction is a matter upon which we have no absolute knowledge, though there are some facts whereupon to base theories. While, as our readers are aware, we believe it to be the proper function of abstract theory to guide actual investigation and experience, and that the indulgence of the habit of theorizing on hypothetical premises generally proves unprofitable, it may not in this instance be amiss to base a theory upon a belief generally prevailing, though not demonstrated,, relating to the molecular structure of fluids.

The hypothesis is that the particles of liquids and fluids are spherical, and so smooth and hard as never to wear by attrition. This conception is about the only one the mind can make of bodies in which the particles are capable of moving with perfect freedom throughout the mass and among each other.

Viscosity of liquids is attributed to the cohesion of molesules, rather than to interlocking through irregularities in form. The latter will not satisfactorily account for all properties of viscous liquids. A quantity of ordinary fine lead shot approximates feebly the character of a similar quantity of liquid. The spheres of lead lack, it is true, the hardness and smoothness attributed to the molecules of fluids, but if we suppose fine shot to be obtained infinitely hard and smooth, such shot would flow almost like a liquid, and the physical properties of a mass of them would not vary greatly from those of some liquids.

These shot could be used as a lubricator, and the investigation of how they would act to reduce friction will give a clue to the probable way in which all lubricators act.

In the first place, being infinitely hard and smooth, the surfaces of the spheres cannot in the least interlock. They, therefore, slide over each other with the greatest facility. Placing a layer of these spheres between two plane material surfaces and moving one surface, we should see each of the shot rolling along under its burden, thus changing sliding friction to rolling friction, and notably reducing the power required to move the given surface. The sporules also flow into and thus rectify irregularities of the bearing surfaces. This is lubrication.

Placing the shot in the same way between an ordinary journal and its bearing, we should find difficulty in keeping them in place; but could they be retained, there would still be the same conversion of sliding into rolling friction. The tendency of the shot to gravitate to the lowest point in the bearing, would gradually force out all of them except a single line or row, which would then sustain the weight of the journal and would so far indent the metal as to cease rolling. The conversion of sliding friction into rolling friction and the lubrication would practically cease, and it would be necessary to supply more shot.

If now we could supply some bond of union between the shot, sufficiently strong to overcome in great measure their tendency to gravitate, and could also supply a bond of attraction between them and the journal, without detracting materially from their power to flow about among each other, the journal would carry them along in its revolution against the action of gravity, and so long as the shot would remain unchanged in character, the journal would remain lubricated. The attraction of cohesion and adhesion are just such bonds, and it is because oils possess these attractions in higher degree than water and some other liquids that the former are better adapted to lubrication than the latter. There is no better lubricator than water when it is convenient to keep it constantly supplied to bearing surfaces. As examples we may refer to Girard's *Palier Glissant*, illustrated and described on page 6, Vol. XXII, of this journal, and to the water bearing of Shaw's propeller pump, illustrated and described on page 118, current volume. In these applications of water to lubrication, the water is forced between the bearing surfaces by hydrostatic pressure.

We see then that, for general use, lubricators must possess a certain amount of cohesive and adhesive attraction. But they must also have the power to retain their cohesion and fluidity under the action of moderate heat, heavy pressure, and contact with metals and air. The oxygen of the air attacks many kinds of oils, rendering some acid and others resinous; and moreover some oils of mineral extraction are contaminated with acids, used in their rectification, which attack metallic surfaces, the oxides of the metals thus produced increasing friction mechanically. The oxides of metals have the power of saponifying vegetable and animal oils, and no doubt this combination often takes place when oils of this kind are used on rusty bearings.

The soaps formed by the union of the saponifiable parts of oils with metallic oxides are hard and insoluble, and are, therefore, much less perfect lubricators than the oils themselves. Some oils, more particularly those extracted from petroleum, are volatile, and evaporate as soon as journals become slightly heated. Oils possessing these defects are unfit for purposes of general lubrication.

Probably nothing else has ever been discovered that possesses in so high a degree all the properties desirable in a lubricator as good pure sperm oil. There have been, however, some close approximations to it in oils extracted from petroleum. Many of the latter are, however, very inferior. Some excellent lubricating oils are also obtained from various seeds. The olive and the castor bean furnish oils very good for lubrication. Olive oil is, however, too expensive for general application to this purpose.

But as no amount of theory can take the place of actual test in mechanical science, we are glad to notice in this connection some recent and important experiments made by Mr. A. H. Van Cleve, General Purchasing Agent for the Camden and Amboy Railroad, relative to the value of different lubricating oils. A full report of these experiments will be found in another column, and we call our readers' attention to it as being perhaps as important a contribution to our knowledge upon this subject as has yet been published.

Of late graphite has been prepared so pure, and has been reduced to so impalpable a powder as to enable it to enter as a competitor with oils for purposes of lubrication. It is probable that the action of this substance on bearings is not analagous to that of oil in the conversion of sliding into rolling friction, but that it acts beneficially because its coefficient of friction on metals and wood is so much smaller than that of metals on metals or metals on wood.

As yet its value as a lubricator is not generally admitted, although we have seen the strongest testimonials in favor of an article called plumbago grease, manufactured by a house in this city.

The "metalline," about which such incredible stories were told a year or two ago, and about which we hear nothing latterly, was prepared in part from graphite. It is possible that this substance (graphite) in a perfectly pure state, or mixed with other substances, may eventually take its place among standard lubricators in general use for machinery; but it has yet to earn its reputation.

## TO SMOKE OR NOT TO SMOKE.

The use of tobacco is an evil, or it is not an evil. In the enormous and increasing consumption of this plant it has become a question of very great importance what effect upon the general standard of health is produced by it. The agitation of this subject has been increased during the last two years, and pamphlets, essays, and lectures have developed in full strength the arguments for and against tobacco using. As smoking is the most popular and most powerful method by which the stimulant effect of the plant is obtained, it is principally upon this habit that the battle is waged.

We have from time to time presented some of the arguments on both sides of the question, our object being to assist in arriving at truth in so important a matter; and though our confirmed taste for smoking and the natural desire to find it a harmless practice have led us to peruse, with peculiar care, all that has been said in its favor, we avow that neither reading nor experience has convinced us that the general use of tobacco is other than an unmitigated evil.

The *Dublin University Magazine* for September of the present year contains by far the most comprehensive review of the subject that has met our notice, and it is the purpose of this article to place some of the facts, stated in this paper and gleaned from the experience and observation of a very large number of eminent physiologists and pathologists, before the American public in a more prominent manner than they would otherwise appear.

Every page of this remarkable paper is so replete with references that from it might almost be compiled a bibliography of the history, uses, and abuses of "the weed."

The first thing that forces itself upon our attention is the enormous consumption of tobacco. The *Food Journal* states that as much money is spent upon tobacco in England as upon daily bread, yet England undoubtedly consumes less of this narcotic, in proportion to its population, than Germany or the United States. The consumption in England has very nearly doubled in twenty years. The annual consumption in Asia, Europe, America, and Australia, as computed by the eminent German statistician Ausland from the most reliable data obtainable, is not less than 970,000,000 pounds. This affords food for comment, but we will confine ourselves to facts and authorities.

M. Barral, who made the official report on specimens of tobacco exhibited at the Paris Exposition, in his surprise at the footings of his estimates of annual production, remarks: "The enormous figures which have passed before the reader's eye testify to the facility with which people fall into excessive expense for the gratification of a pleasure which has for its principal aim to kill time and to stupefy the mind."

The active principles of tobacco are nicotine, a concrete oil called tobacco camphor, and an empyreumatic oil. The two last are active poisons, but not so deadly as the first, which, according to Taylor, is one of the most virulent poisons known. One drop of it kills a rabbit in three minutes and a half. We need not quote other authorities on this point, as all agree with Taylor as to the character of these substances.

The disease called locomotorataxy, which is a general paralysis of the nerves, is a disease that was unknown forty years ago. Now it has become quite common. Martin ascribes its origin and prevalence to the use of tobacco.

Dr. Richardson, himself a smoker, says: "Smoking produces disturbances—(*a*) in the blood, causing undue fluidity, and change in the red corpuscles; (*b*) in the stomach, giving rise to debility, nausea, and, in extreme cases, sickness; (*c*) on the heart, producing debility of that organ and irregular action; (*d*) on the organs of sense, causing, in the extreme degree, dilatation of the pupils of the eye, confusion of vision, bright lines, luminous or cobweb specks, and long retention of images on the retina; with other and analogous symptoms affecting the ear, namely, inability clearly to define sounds, and the annoyance of a sharp, ringing sound, like a whistle or a bell; (*e*) on the brain, suspending the waste of that organ, and oppressing it if it be duly nourished, but soothing it if it be exhausted; (*f*) on the nervous filaments and sympathetic or organic nerves, leading to deficient power in them, and to over secretion in those surfaces —glands—over which the nerves exert a controlling force; (*g*) on the mucous membrane of the mouth, causing enlargement and soreness of the tonsils—smoker's sore throat—redness, dryness, and occasional peeling off of the membrane, and either unnatural firmness and contraction, or sponginess of the gums; (*h*) on the bronchial surface of the lungs when that is already irritable, sustaining the irritation and increasing the cough."

This authority, however, claims that the diseases caused by tobacco are functional, not organic or specific. This does not matter much, except as encouragement to those who desire to recover from ill health resulting from smoking.

M. Decaisne recognizes a functional disease of the heart (narcotism of the heart) as caused by tobacco, distinct symptoms of which were observed by him in twenty-seven out of thirty-eight, boys aged from nine to fifteen, who smoked more or less.

It is a fact well established that before adult age the use of tobacco produces more serious disturbance than later in life.

M. Beau notices eight cases of *angina pectoris* caused by the use of tobacco.

Professor Lizars records several cases of cancer of the tongue and lips caused by the use of the pipe. The writer has known one such instance, and never wishes to see another example of such terrible suffering resulting from a worse than useless habit.

Dr. Taylor says those who suffer from functional disorders are ready "to attribute the derangement to any other cause than the real one."

Experiments made by Dr. Druhan seem to indicate that tobacco poison in an overdose may produce effects which render even small doses dangerous ever after.

Dr. Corson corroborates the opinion of M. Beau as to *angina pectoris*.

But we will make no further citations. If tobacco has any applications useful to mankind, we are satisfied that smoking, chewing, and snuffing are not of them. We may use tobacco to kill the insects which infest our rosebushes and conservatories; but, if we will continue to poison ourselves with it, let us make no pretences about it. We do it to gratify a depraved appetite from which we are irresolute to break loose. Let us neither believe nor pretend to believe that it is a blessing. If tobacco poisons our bodies, let it not also corrupt our morals and make hypocrites of us.

## THE CONDITION OF MECHANICS AND LABORERS IN ENGLAND.

The condition of the working classes in England has become so low and degraded that the attention of thoughtful men of all shades of opinion is attracted to it; and it is a serious question to know what remedy to apply to save a vast population from sinking to a depth of corruption and misery unparalleled in the history of modern civilization.

A plan has been proposed by Mr. Scott Russell, the architect of the Crystal Palace, the Great Eastern and other large works, to form two Committees, "a Council of skilled workmen," and "a Council of legislators," to whom shall be referred the discussion of the whole question and the suggestion of proper remedies.

Mr. Russell says: "While there is no finer breed of working men in the world than the British skilled workman, there

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is no civilized country in which his interests are so little cared for, and in which the institutions, laws, and customs are so unfavorable to his material well being and to his moral development." This is pretty strong language, but it appears to be confirmed by the observations of other reformers. As the result of careful inquiry among workmen, and extensive visitation of manufactories and dwellings, both in England and on the Continent, the chief evils to be remedied were classified under the following seven heads:

1. The want of family homes, clean, wholesome. and decent, out in pure air and sunshine.

2. The want of an organized supply of wholesome, nutritious, cheap food.

3. The want of leisure for the duties and recreations of family life, for instruction, and for social duties.

4, The want of organized local government, to secure the well being of the inhabitants of villages, towns, counties and cities.

5. The want of systematic, organized teaching, to every skilled workman, of the scientific principles and most improved practice of his trade.

6. The want of public parks, buildings, and institutions for innocent, instructive and improved recreation.

7. The want of adequate organization of the public service for the common good.

While the English legislators and Council of skilled workmen are discussing the seven points raised by the above classification, it may be well for us to consider how far we are better off than our neighbors across the water. We recently took up the first topic—the want of family homes out in pure air and sunshine—and tried to show that it was the duty of capitalists to see that the homes of mechanics were in the open air and made as comfortable as possible.

Such a result can only be attained in New York by a system of rapid transit, for it is in vain to look for decent dwellings and wholesome air in the crowded tenements of the city. The question of cheap food is of hardly less importance, and as it is possible by organized effort to feed a vast army with nutritious meat biscuit, good bread, and fresh provisions, we have the best of information that an organized supply of wholesome food is profitable for our working men. If half the effort were to be made, to form our workmen into associations for the purchase of provisions, that there is to inveigle them into time-consuming, wasteful and extravagant political clubs, a vast amount of good could be accomplished; and if the late Commissioners of Public Parks had used the organization of their office for the protection of the men under their employ, instead of setting them an example of prodigality by spending nearly five million dollars in a little more than a year in doubtful experiments, they would have earned the thanks of the whole community. Our mechanics have so long felt the want of leisure for recreation and amusement that, when they do have a holiday, they hardly know what use to make of it. They are as graceful in their efforts at fun as an elephant would be in a china shop. They have had no experience at amusement, and do not know where the fun comes in. It is not their fault, but the misfortune of the circumstances in which they have lived; and it is high time that workmen were secured proper time for the recreations of family life, and for social duties. Our German citizens possess the secret of obtaining their share of amusement in the most economical and innocent manner.

It was partly in consequence of a knowledge of this fact that Prince Albert joined so heartily with Mr. Scott Russell in all of his efforts to alleviate the condition of the English poor. Prince Albert had witnessed the merry gatherings of mechanics and humble tradespeople on the Continent, and the sombre and sad fate of the English workmen could not fail to attract his notice by the contrast it afforded. We inherit too much of the English trait in this matter, and can afford to take more kindly to amusements of a proper character than we are now accustomed to do. The want of systematic teaching to every skilled workman is a topic which has been fully discussed in our columns. The loss to manufacturers, in teaching their workmen by experience, is one of the heaviest discounts to be made from the profits of any enterprise in the country. No way of acquiring knowledge is so costly as this. We have heard a large manufacturer say that it had cost him five hundred thousand dollars to teach his workmen how to conduct his business, a greater part of which sum could have been saved if the men had had an opportunity to acquire a knowledge of the scientific principles upon which the business was based. And this knowledge could easily have been taught them in our public schools.

The English are very right in demanding systematic, organized teaching to workmen of the principles involved in the practice of their trades. And a good form of protection for us would be to meet skilled labor by something better, and to do this we must look well to our schools.

The want of a suitable public park is not so much felt in New York. Our Central Park is visited by many thousand persons, and is of incalculable value to all classes of citizens, the rich as well as the poor; but "buildings and institutions for innocent, instructive and improving recreation" are quite as much a want and a necessity with us as in England. The present appears to be the time of great awakening for the aid and improvement of laboring men of all classes.

For those who work with their brains, life assurance societies have been organized,—for the toilers with hands, we trust that cheerful homes, wholesome food, suitable leisure, and systematic teaching will grow out of the agitation of the question, in this country and Europe.

THE lowest education that teaches self control is better than the highest that neglects it

## PROTECTION TO AMERICAN INDUSTRY.

The city of New York and the country at large owe a debt of gratitude to Mr. Peter Cooper, which entitles the opinions of that gentleman, upon any public question, to the most respectful attention. A pamphlet from his pen upon the subject of "Protection to American Industry" has reached our table, and is, we understand, being widely circulated.

While we concede to Mr. Cooper a high place among philanthropists, we cannot accord him equal rank as a political economist; and though we are in favor of "protection" as we understand it, we find, in this pamphlet, neither any new argument, nor any old one so repeated as to add to its force. In fact, the chief weight and importance possessed by the essay lies in the influence of the name of its author.

The principal part of the document is occupied with an arraignment of the English government for its crimes against colonial commerce. The present embarrassment of commerce and trade are attributed to the inflation of paper money. The nations are considered as engaged in what Mr. Cooper styles "a commercial war," in which, if we would conquer, we must adopt "a policy that will maintain the National Government and pay the nation's debt out of duties on imports. The heaviest duties should be laid on all articles of luxury, and the lightest duties on all articles that will aid in securing a diversified employment to our people."

This is, we think, a fair synopsis of the essay, which is, as we have intimated, mainly a historical *resumé* of the acts of commercial greed committed by the English nation, and which greed, upon the maxim that "all is fair in war," we understand Mr. Cooper to counsel us to imitate, at least so far as will maintain and vindicate "the political and financial power" of our nation.

It will be seen that Mr. Cooper makes the great mistake of most old school business men, namely, that paper currency is the origin of our commercial depression. We think it can be proved (though we shall not attempt the proof in this article) that a self regulating paper currency is the best for all commercial purposes. The trouble has been that instead of thus being self regulating—that is, convertible into interest bearing bonds at will of the holder, and *vice versâ*—the supply has been increased or diminished, fitfully, in the interests of speculation; at one time being abundant, at another scarce. The demands of trade are not met by such a currency.

The taxation of imports to the highest extent, within the limits of absolute prohibition, is what is meant by protection, with the tariff advocates of Mr. Cooper's school.

It would be well for all who so fluently propose remedies for commercial disease by tariff tinkering, to reflect that all taxation must, of necessity, be laid upon waste or consumption. Production cannot be taxed, because it can shift any burden of taxation to the shoulders of consumers. A single instance will suffice to illustrate. The present internal revenue tax on matches is added by the manufacturer to the cost of the article, and a profit on the whole is exacted from consumers, so that the manufacture is really improved by the impost. If the burden should be so great that the manufacturer could no longer sell, his stock on hand will begin to deteriorate. On this waste he will pay the tax.

This law of political economy is fundamental. It depends upon the very nature of the relation between buyer and seller. No attempt to change it can ever succeed. To equalize taxation among individuals, therefore, implies the equalization of waste, or consumption. Those who waste or consume most will be taxed most by any imposition levied upon the necessaries or luxuries of life. This being admitted, it is evident that it matters nothing whether imported articles be taxed, or whether domestic products support all the burden so far as expense of living is concerned. So long as the burden must be borne we may carry it as well on one shoulder as the other, notwithstanding the outcry that protection implies increased cost of the necessaries of life. But it matters very much indeed which is taxed, when one has to compete in the market with the other. In each case the consumer will pay the tax, but if importations are checked, he consumes home made goods, and thus encourages home production.

The encouragement of home production means the absence of the competition of labor living on one plane, with labor living on a lower plane of civilization, to which free trade would inevitably force down the laboring classes of this country. As "commercial war" exists, the operation of free trade would be simply to drive the manufacturing population into agriculture, at wages approximating those of the English farm laborer.

The mistake that production can be taxed leads to other fallacies, which we will not discuss in this article. The pamphlet of Mr. Cooper serves a certain purpose in the furtherance of the cause of protection, but its inherent weakness. will, we fear, furnish the opponents of the doctrine with a mark for the shafts of satire which will greatly neutralize its effect, even with those who follow the prestige of a name rather than convictions derived from sound premises and correct logic.

## SCIENTIFIC INTELLIGENCE.

### OLIVE OIL AS A PURIFIER OF CARBONIC ACID.

In the manufacture of carbonic acid for mineral waters and soda fountains, in consequence of impurities in the limestone employed for the evolution of the gas, certain disagreeable empyreumatic oils and offensively tasting gases are apt to go over; and, unless separated in some way, they will impart an unpleasant flavor to the mineral water. To obviate this difficulty, E. Pfeiffer suggests saturating pumice stone with olive oil, and passing the gases through it in the usual way. The oil absorbs the bad gases, and can be regenerated for subsequent use by heating it to expel the absorbed impurities. After becoming quite impure, it is still suitable for the manufacture of blacking or for application as a lubricator. It is said that Mallett employs this method to absorb the hydrocarbon products in his process of obtaining ammonia directly from coal tar. As much of our limestone contains organic matter, which gives a peculiar smell to carbonic acid made from it, this method of purifying the gas by passing it through olive oil is worthy of trial.

### PRACTICAL USE OF THE CARBONIC ACID RESULTING FROM FERMENTATION.

The same ingenious inventor has devised a plan for economizing the waste carbonic acid resulting from the fermentation of wort, the manufacture of vinegar, from champagne vats, and the like. The fermenting vessels are covered, and, by means of exhausters, the air is drawn off and is found to contain from twenty to twenty-five per cent carbonic acid. This can serve for the manufacture of bicarbonates, and, if the gas were to be condensed, could be converted into a motive power, employed in the manufacture of soda water, or used for artificial refrigeration. At any rate, there would appear to be no reasonable excuse for wasting so much carbonic acid. If somebody would only devise a practicable plan by which the enormous amount of carbonic acid, produced by gas burners or exhaled from the lungs of large audiences in our churches, theatres, and public halls, could be drawn off, got out of the way, and devoted to some purpose more useful than suffocating and poisoning multitudes of people, he would confer a great boon on mankind, and would be cordially welcome to any remuneration he could make out of it. In other words, why cannot somebody devise a system of ventilation that will be accepted at once as feasible, and thus put a stop to complaints on this subject?

### ACTION OF SULPHUROUS ACID ON PHOSPHATES.

B. W. Gerland has been making some important experiments on the action of aqueous sulphurous acid upon phosphates, which have developed some points of great practical importance, especially in their bearing on the manufacture of artificial composts and soluble phosphates. He finds that aqueous sulphurous acid does not, like the strong acids, wholly decompose the phosphates, but transforms them into soluble modifications. The ordinary bone phosphate, called tribasic, is easily soluble in sulphurous acid, and if the solution be hastily boiled and evaporated in open vessels, a crystalline double salt, a mixture of tribasic phosphate with a sulphite of lime, will separate. This new and remarkable body is said to be quite permanent, and, in reference to its use as a disinfectant and upon farm land, is certainly deserving of especial notice. If we can, by means of sulphurous acid, decompose the phosphates, we shall avoid the expense of sulphuric acid, which must first be made from sulphurous acid, and obtain a product not so difficult to handle, and capable of a greater variety of uses than the superphosphate made in the old way. The author has studied the behavior of sulphurous acid towards other phosphates, but, as the results are purely theoretical, we omit them.

### PURE OXYGEN FOR INHALATION.

Eliot recommends for the preparation of oxygen gas, to be used in medicine, the employment of a mixture of equal parts of peroxide of barium and peroxide of lead. By pouring dilute nitric acid upon these salts, there is a violent effervescence and a copious evolution of pure oxygen gas. For greater security, the gas may be afterwards washed in water. As very little heat is necessary, the operation can be performed in any stout bottle, thus dispensing with the usual retorts.

### A MEASURE FOR THE INTENSITY OF LIGHT.

Dr. Vogel proposes *nitroprussidiron* as a suitable salt for determining quantitatively the intensity of light. For the preparation of this reagent, dissolve chemically pure oxide of iron, best obtained from the oxalate, in hydrochloric acid, and evaporate nearly to dryness to expel the excess of acid; and after filtering, add an aqueous solution of nitroprussidnatrium in the proportion of three of the iron to two of the latter. There is usually a slight precipitate produced by this mixture, which can be collected on a filter; but this operation must be performed in a dark room. We have now a liquid excessively sensitive to the action of sunlight. By exposing a small quantity of a known specific gravity to the action of light, a precipitate of Prussian blue will instantly begin to fall; and, on redetermining the specific gravity in the dark chamber, its decrease will be found to be proportional to the precipitate; and we have thus the data for measuring the intensity of light. It was found by Dr. Vogel that that the liquid, exposed for forty-eight hours before a kerosene lamp, was not in the least affected, but a piece of magnesium wire, when burned, immediately produced a precipitate. By employing a long instrument graduated in millimeters, it would appear to be possible to measure the intensity of the light by the number of millimeters occupied by the precipitate. The invention has an important bearing upon photography.

### OZONE ETHER.

A correspondent asks if there is any way by which ozone can be preserved dissolved in a liquid. Such a preparation is recommended by Dr. Richardson, which, however, is said by Böttger not to contain any ozone, but something equivalent to it, namely, binoxide of hydrogen. By agitating ether in a flask with binoxide of barium, adding gradually perfectly pure and very dilute hydrochloric acid, occasionally cooling and subsequently allowing the ether to settle, we obtain a liquid which has been recommended as a disinfecting, bleaching, and cleansing agent, and as a test for chromic acid, which it instantly turns indigo blue.

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## TIMELY SUGGESTIONS.

**Every Employer** should present his workmen and apprentices with a subscription to the SCIENTIFIC AMERICAN for the coming year.

**Every Mechanic and Artisan** whose employer does not take the SCIENTIFIC AMERICAN should solicit him to subscribe for 1872.

**Now is the Time** for old subscribers, whose subscriptions expire with the year, to renew.

**Now is the Time** for new subscribers to send $3 and commence with the new year.

**Now is the Time** for forming clubs for the new year.

**It will pay** any one to invest $3 for himself, his sons, or his workmen, for one year's subscription to the SCIENTIFIC AMERICAN.

**It is easy** for any one to get ten subscribers at $2·50 each, and for his trouble obtain the splendid large steel plate engraving, worth $10.

**It is easy** for any old subscriber to get a new one to join in taking the paper. Those who do will receive a bound volume of the "Science Record" for 1872. See description of this work on page 353, SCIENTIFIC AMERICAN, issue of December 2d.

**It is no more trouble** to remit $6 for two subscribers than $3 for one.

**If any mechanic** whom you ask to subscribe says he cannot afford it, tell him he cannot afford not to.

**If any one** wishes specimens of the paper to examine before subscribing, tell him to write to the publishers and they will cheerfully mail them.

**If any one** wishes an illuminated Calendar for 1872, to hang in his office or shop, he can have it sent free on sending a request to this office.

**If handsome illustrated posters** and prospectuses are wanted to assist in obtaining subscribers, send to the publishers of this paper.

**It is the intention** of the publishers of the SCIENTIFIC AMERICAN to make the paper next year better and handsomer than any previous year during the last quarter century it has been published.

**It is the intention** of the publishers to illustrate, by superb engravings, all new and practical inventions and discoveries that may be developed during the year.

**For Prospectus and terms to Clubs** see last page.

AN ingenious Frenchman has invented a process for treating common woods, which makes them of a closer texture, harder grain, and greater density, and so enables the cheaper kinds of wood to take a polish. The mode is as follows: The surface is first planed perfectly smooth, and then rubbed with diluted nitrous acid. An ounce and a half of dragons blood, dissolved in half a pint of spirits of wine, and half an ounce of carbonate of soda are mixed together and filtered; and the liquid is then laid on the wood with a soft brush. The treatment should be repeated after a short interval, and the wood will then possess the outward appearance of mahogany. If the polish is not sufficiently brilliant, rubbing with cold drawn linseed oil will improve it.

MR. A. A. LOW, treasurer of the New York Chamber of Commerce Chicago fund, acknowledges the receipt thus far of $906,310.67—nearly a million dollars.

YOU cannot escape from anxiety and labor; they are the destiny of humanity.

## NEW BOOKS AND PUBLICATIONS.

THE SCIOPTICON MANUAL. Explaining Marcy's New Magic Lantern, and Light; including Magic Lantern Optics, Experiments, Photographing and Coloring Slides, etc. By J. L. Marcy, Optician, No. 1340 Chestnut Street, Philadelphia, Pa.

This little work, which may be obtained of the author, is calculated to assist those who need instruction in the use of the sciopticon or magic lantern. This instrument, in its improved form, affords a means of much instruction and amusement; and the above work, while in itself interesting and instructive, will be found an invaluable guide to the use of the most entertaining apparatus yet invented by opticians.

ELEMENTARY PRINCIPLES OF CARPENTRY. By Thomas Tredgold. Revised from the original edition, and partly re-written by John Thomas Hurst. London: E. & F. N. Spon, 48 Charing Cross. New York: 446 Broome Street.

Mr. Tredgold lived to revise the second edition of his original work on *Carpentry;* but the time that has elapsed since his death has increased the general knowledge upon the strength of materials, and has also given birth to new inventions and appliances, which have made another revision imperative, in order to bring the work up to the improvements of the time. The large and increasing use of iron, in connection with wood in bridge building and in general architecture, is one of the advances made since the second edition was published. On this account, the editor of the present edition has entirely re-written the chapters on pillars, bridges, and timber, and has added sections to the chapters on coffer dams, scaffolds, etc., besides making such alterations, wherever needed, as will adapt the work to present needs. A very comprehensive work in its revised form, it supplies a want long felt, and will, we have no doubt, meet with a large sale. The carpenter will find a great variety of useful information in the chapters treating of the equality and distribution of forces, resistance of timber, construction of floors, roofs, domes or cupolas, partitions, scaffolds, staging, and gantries; construction of centers for bridges, coffer dams, shoring and strutting; wooden bridges and viaducts; joints, straps, and other fastenings, timber, etc. To these chapters are appended twenty-one useful tables, calculated to facilitate computation in all departments of carpentry, and a copious index, which renders every thing in the book available for easy reference. The work contains 517 printed pages, and 48 full page plates, besides numerous smaller engravings throughout the text. It is printed in excellent style, and is handsomely bound in cloth.

ANNALS OF THE DUDLEY OBSERVATORY. Vol. II. Albany: The Argus Company, Printers. 1871.

The most important and interesting feature of this volume is the record of the meteorological observations made during a period of five years, from 1862 to 1871, under the supervision of G. W. Hough, A. M., Director of the Dudley Observatory. Nothing like such a continuous and accurate series of observations for so long a period has ever before been published or made. In fact, they could not have been made with any less perfect and automatically registering and printing instrument than the "Automatic Registering and Printing Barometer," invented and perfected by Professor Hough, and used by him during the period named. This instrument not only traces a continuous curve of the varying hight of the barometric column, but so proportionally magnifies the fluctuations of the column that even the smallest variations become apparent. The importance of this will be appreciated when we state that frequent fluctuations of the column, though almost imperceptible, seem to always precede, for some time, the occurrence of violent disturbances in the atmosphere, and that this fact has been discovered by the use of Mr. Hough's instrument. In his remarks upon this point, Professer Hough says:

Some years since, we pointed out the intimate relation existing between the barometric disturbance and the weather. We remarked that this element of disturbance was a better guide in prognosticating storms, than the mere change of barometric hight. An examination of the mean daily and mean monthly curves for barometric disturbance shows that this opinion is founded in nature.

It will also be seen, by an inspection of the tables exhibiting the mean daily disturbance, that storms are invariably accompanied with excessive barometric fluctuation. In fact, a pretty correct history of the weather may be determined by an examination of this element alone; and when taken in connection with changes of pressure, it indicates, in a very marked manner, the atmospheric phenomena.

Some hours previous to the arrival of a great storm, the "barometric disturbance" increases, amounting, in some cases, to seven times the change of pressure in a given interval of time. It is our opinion that the waves of pressure are propagated in the upper regions of the atmosphere, some hours before the storm reaches any given locality at the surface of the earth.

The record is made for each hour during the five years, and the curve of hourly disturbance, when compared with the weather record accompanying, clearly sustains the views expressed by Professor Hough. Diagrams are given, showing the mean hourly barometric disturbance, the mean monthly disturbance, simultaneous barometric curves at different points, mean hourly velocity of the wind, mean monthly temperature for nine years, etc. A most interesting part of the report is the account of observations at the time of the total eclipse of the sun in 1869. The book contains, also, much other important and interesting matter pertaining to the regular work of the observatory. It is, probably, the most important contribution to meteorological science yet published.

A REPORT OF SURGICAL CASES TREATED IN THE ARMY OF THE UNITED STATES, FROM 1865 TO 1871. Washington Government Printing Office. 1871.

This is a large quarto with illustrations, the character of which is set forth in its title. Its importance will, however, only be apparent to physicians and surgeons, who will find in it statistics of great value. The minute details given of operations which, a few years since, were scarcely known to surgery, are especially important as guides in the treatment of similar cases hereafter. The compiler and editor of the work, George A. Otis, Assistant Surgeon U. S. A., has done his work with scrupulous ability.

The Thanksgiving Number of HEARTH AND HOME, published by Orange Judd & Co., 245 Broadway, New York, is an evidence of the liberality and good taste which have secured for this journal a well deserved popularity and large circulation. As a family paper, for large and small, it has purity of tone, originality, and beauty, to recommend it, while it is edited with intelligent appreciation of what the masses of rural and city readers like to read. Its illustrations are excellent: in short, we shall have sufficiently described each of its features when we say they are all, of their kind, excellent. The more such papers are circulated, the better it will be for the mental and moral health of the rising generation.

THE ELEMENTARY MUSIC READER. A Progressive Series of Lessons, prepared expressly for use in Public Schools. Book First. By B. Jepson, Instructor of Vocal Music in the New Haven Public Schools. New Haven, Conn.: Charles C. Chatfield & Co., 458 Chapel Street, opposite Yale College.

We have long been impressed with the importance of substituting the reading of music for the rote singing practiced very generally in public schools. The importance of a knowledge of musical notation, and the power of reading it with facility to satisfactory progress in music, needs no argument. The system of teaching this branch of the art, generally employed in this country, is, in our opinion, very defective, its chief fault being the transposition of the syllables used in solfeggio exercises, with the transposition of the scales, instead of maintaining them, without regard to key, in one position on the staff, as in the Italian method. We are sorry to see that, in Mr. Jepson's work, this error is retained—the more so, as it is in all other respects a capital book for the field it is intended to occupy, giving evidence that its author is a practical and thorough teacher.

HALF HOURS WITH MODERN SCIENTISTS. Huxley—Barker—Stirling—Tyndall. New Haven, Conn.: Charles C. Chatfield & Co.

This is one of, what the publishers style, the University Scientific Series of Publications, designed to place, in a cheap form, the advance thought in the scientific world. It contains the following essays: "On the Physical Basis of Life"—Professor T. H. Huxley. "Correlation of Physical and Vital Forces"—Professor G. F. Barker, M.D. "As Regards Protoplasm—Reply to Huxley"—James Hutchison Stirling. "On the Hypothesis of Evolution"—Professor E. D. Cope. Scientific Addresses, by Professor John Tyndall. "On the Methods and Tendencies of Physical investigation. "On Haze and Dust," and "On the Scientific Use of the Imagination."

The names of these celebrated scientists and authors are so well known, and their popular style of discussion is so favorably appreciated, that it is hardly necessary to say this work possesses an interest and value, second to no other of its size ever issued from the American press. It is a medium octavo, plainly bound, but handsomely printed, and will meet with an extensive sale.

SERVING OUR GENERATION, and GOD'S GUIDANCE IN YOUTH. Two Sermons, preached in the College Chapel, Yale College, by President Woolsey. New Haven, Conn.: Charles C. Chatfield & Co.

This is a beautiful little volume, printed on tinted paper, and neatly bound in cloth. As the work of one of our most celebrated scholars and divines, it will be eagerly sought by those who delight in pulpit literature.

THE CIVIL ENGINEER'S POCKET BOOK OF MENSURATION Trigonometry, Surveying, Hydraulics, Hydrostatics, Instruments and their Adjustments, Strength of Materials, Masonry, Principles of Wooden and Iron Roof and Bridge Trusses, Stone Bridges and Culverts, Trestles, Pillars, Suspension Bridges, Dams, Railroads, Turnouts, Turning Platforms, Water Stations, Cost of Earthwork, Foundations, Retaining Walls, etc.. etc.. etc. In addition to which, the Elucidation of Certain Important Principles of Construction is Made in a More Simple Manner than heretofore. By John C. Trautwine, Civil Engineer. Philadelphia: Claxten, Remsen & Haffelfinger, 819 and 821 Market street.

The above comprehensive title relieves us of the necessity of an analysis of this work, and the name of its author is a sufficient guarantee of the value of its contents to any engineer and mechanic. The book is bound in morocco, with clasp, in the pocket book style, and is copiously indexed. It is in every way, in matter, style of publication, and binding, worthy of commendation, being in itself a complete compendium of engineering science, by the use of which much time and labor can be saved to any practical mechanic.

## Declined.

*Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:*

DIMENSIONS OF BOILERS.—J. McC.
PROTECTION OF BUILDINGS FROM FIRE.—R. B. B
RAILROAD ACCIDENTS.—G. T. F.
SLIDE VALVES.—F. A.
SPIRITUALISM.—J. L. V.
ASTRONOMICAL DISCOVERY.—L. B. D.
BOILER EXPLOSIONS.—K. H.
DISEASE AND DIRT.—F. H. B.
MODERN SURGERY.—N. F. W.
WASTE OF WATER.—H. B. P.
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QUERIES.—L. D.—O. S.—R. V. P.—T. E. L.—W. H. G.


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# Practical Hints to Inventors.

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### How Can I Obtain a Patent?

s the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

### How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

### Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

### Caveats.

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### To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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**"We consider** *Burnett's Flavoring Extracts* superior to any others."—*Parker House, Boston.*

## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

MOTH PROOF BOXES.—Raphael M. Seldis, of New York city, assignor to Jason Crane, of Bloomfield, N. J.—This invention provides boxes, packages, trunks, and similar receptacles with an inner lining, whereby moths will be effectually excluded, and the consequent destruction of the contents prevented. The invention consists in applying a coating of thin gutta percha to the inner side of every such receptacle. This not only makes the same practically airtight, to prevent dust and other impurities from entering, but is also injurious to moths, as, by its peculiar odor and exhalations, it is claimed to destroy them.

MACHINE FOR THREADING BOLTS.—Charles Schneider, of Newark, N. J.—This is a screwcutting chuck which can be conveniently opened apart after a screw thread has been cut, to enable the removal of the finished screw or bolt without necessitating the ordinary tedious process of unscrewing. The invention consists in making the chuck in sections, which are pivoted to sliding pins in such a manner that they can be moved forward, and swung apart conveniently after a screw has been cut; whereby considerable time in the cutting of bolts and screws is gained, and the expense of their manufacture consequently reduced.

BLACKING BOXES.—Thomas R. Sinclaire, of New York city.—This box may be stamped from a single piece of tin or other sheet metal, or made of pieces soldered together, as may be deemed advisable or convenient by the manufacturer. Instead of making the sides of the box perpendicular with the bottom, and thereby leaving a sharp corner to retain a large portion of the blacking, as is the case with the blacking boxes in common use, the sides are placed on a level, leaving an angle still, but an angle so obtuse that the brush readily reaches the last particle of blacking in the corners. This formation is claimed to not only save at least ten per cent of the blacking, but to save the brush from injury sustained in forcing it into a sharp corner and against the sharp edge of the box, besides a great deal of trouble and annoyance to the user.

PROPELLING POWER.—Nathaniel B. Baldwin, of Chicago, Ill.—This is an improved apparatus for drawing plows, wagons, reapers, mowers, and other machines, and for propelling thrashers and other stationary machinery. It is a four wheeled traction engine, the driving wheels of which are turned by pivoted levers actuating pawls which engage with ratchets.

APPARATUS FOR FORCING LIQUIDS.—Mancelia E. Ogden, of New York city.—This invention has for its object to furnish a simple, convenient, and effective apparatus for forcing beer, ale, or other liquids out of their casks by atmospheric and hydraulic pressure. It consists in a combination of a tank with a slide and with pipes and valves, a pivoted lever, connecting rod, weighted lever, catch, bent arm, sliding rod, rod, pipe and stop cock provided with valve and stop cock, and an air tank provided with stop cocks, the whole being constructed in a peculiar manner, the nature of which precludes detailed description in this place.

TELEGRAPH INSULATORS.—George W. Kidwell, of Elwood, Ind.—The insulator is made of glass or other good non-conductor and is divided longitudinally into two or more parts, and is made tubular for receiving the telegraph wire. There is a groove around the insulator, by means of which the insulator is secured in the block by a pin. There is a hollow cavity in the flat side of one of the parts of the insulator, and a round projection on the other part which fits into the cavity. This is simply for holding the parts of the insulator in place, and to aid in adjusting it in the block. There is a slot in the block communicating with the insulator hole. This slot allows the telegraph wire to be slipped into the hole in the block; the parts of the insulator are then applied to the wire, thus enclosing it, and then slipped into the block on the pole, where the insulator is secured by a pin. By this mode of applying an insulator to the wire, it is claimed much valuable time is saved in putting up and repairing the wires, and the cost of the insulators is greatly reduced.

AIR REGISTERS.—Edward A. Tuttle, of Brooklyn, N. Y.—This invention relates to improvements in the registers used for regulating the passage of air; and it consists in a combination with the slats of a spring or springs in such a manner as to retain them in any position as may be required for controlling the passage of the air. By the employment of these springs, an elasticity is imparted to the support of the slats by which they are adapted to receive slats of different lengths, which is desirable, because they often vary in length, though made from the same pattern; but care will be taken to have the slats for each register as nearly the same length as possible. The said spring plates also afford a means for compensating for variations in the thickness of the sides of the frames commonly supporting the journals, which also often occur in casting, thereby obviating the necessity of fitting them, as they have had to be heretofore. The said arrangement is highly desirable over registers of railroad cars, to prevent them from rattling, as well as to hold them from turning.

DITCHING PLOW.—Henry D. Williams, Fairview, Iowa.—The construction of this plow enables the draw bar to be so adjusted as to draw the machine forward in a straight line, or to cause it to move to the right or left to pass obstructions, or change the direction of the ditch without its being necessary to change the position of the capstan for that purpose. While the nature of the invention precludes a more detailed description of parts, we may say something further relative to the merits of the invention. It appears to us to be well adapted to the purpose, in that it can be made as strong and durable as may be desired, there being no complications introduced likely to get out of repair. The draft strain upon the cutters is supported and the whole machine bound together by a metallic strap or band. The mold board is so elongated as to act with efficiency in throwing out the earth to the proper distance from the ditch. A shoe gages the depth of the cutting, the whole forming a very compact, solid and easily manipulated implement.

MECHANICAL MOVEMENT.—William F. Jones, of Easton, Kansas.—This invention relates to a new and useful improvement in a mechanical apparatus for imparting power and motion by means of horse or other motive power applied thereto for operating tools or machinery. A driving face wheel is made to revolve on a horizontal arm of a vertical stand. A spider, consisting of four, more or less, tubular arms, is attached to the stand. Pinion wheels, with which the driving gear wheel meshes, are employed, equidistant from each other on the face of the wheel. A shaft passes entirely through the spider. One of the pinions may be made fast on this shaft, so that the shaft will revolve, and the other pinion may be loose and revolve on the shaft. In the former case motion may be taken from the end of the shaft; but in case one or both of the pinions revolve on this shaft, they may have a socket hub, or center, so constructed as to couple and impart power and motion to other mechanism or tools for any purpose which may be required. Motions in reverse directions may be obtained either for conveying power and motion, or turning augers, drills, or other tools. The pinions, one or more, may have socket hubs for the introduction of coupling-bars or tools, as may be desired.

BEE HIVE.—Sandy S. Collins and Hiram Senseman, of Tremont, Ohio.—This improvement provides a double bottom to hives for the reception of the droppings of the bees, and, by a peculiar device, to serve as a moth trap. Other features are the strengthening of the comb frames, provision for the ventilation of the hive, for the protection to the bees while inserting the comb frames, for the convenient inspection of the honey boxes, prevention of damp in the hives, etc., etc.

ANIMAL TRAP.—Nathan S. Howell, of Tualatin, Oregon.—This invention consists in the arrangement of a trap having two pivoted toothed jaws, which catch and hold the animals by their bodies, the jaws being actuated like the jaws of the ordinary double steel trap.

ELECTRIC LINING FOR SAFES.—Edwin Holmes, of Brooklyn, N. Y. and Henry C. Roome, of Jersey City, N. J.—This invention relates to an improved method of applying electric alarm apparatus to safes, vaults, and other structures, with the view to greater efficiency of action and simpler mode of application. The method heretofore employed has been to apply a lining connected with the electric apparatus directly to the inside of the safe or vaults. Whenever such a safe or vault is attacked by burglars; it is injured or destroyed before the lining is reached and the alarm given. To remedy this defect the inventor builds, around the structure to be guarded, an exterior case, to which a lining, which may consist either of metallic sheets or a network of wires, is applied, and which constitutes an exterior electrical burglar proof safe of itself, so that if any attempt be made to enter by cutting, drilling, or breaking through, an alarm will be sounded before the structure guarded is itself reached.

APPARATUS FOR FILTERING LIQUIDS.—Thomas R. Sinclaire, of New York city.—The object of this invention is to overcome some difficulties which have been met with in the use of the filtering apparatus for which letters patent of the United States were granted to the same inventor, dated April 27, 1869, and July 6, 1869. It consists in a perforated tube or receiver within the filtering vessel, of conical or other form, connected with the bottom of the vessel and extending upward therefrom, consisting of perforated metal, wire gauze, and textile or fibrous material, or their equivalents, the same being surrounded by the charcoal or filtering material. The filtering vessel may be of any suitable size and form, provided with a conical or oval top or cover, with a ring or eye for lifting and handling the same. A flange is formed around the rim of the vessel. The cover is so securely confined to the vessel by bolts, that the connection will allow liquids to be filtered under pressure. The filtering vessel is filled, or nearly filled, with charcoal or other filtering material for clarifying and purifying liquids. Charcoal is usually employed. In filtering under pressure on the old plan, or without an interior perforated receiving tube or its equivalent, more or less of the liquid, it has been found, will force its way between the charcoal and the side of the vessel, or through channels in the coal itself, and will consequently be but partially filtered or clarified, thus rendering the whole operation imperfect and unsatisfactory. By the introduction of the receiving tube all the liquid is compelled to pass and to be regularly distributed through the body of the filtering material and into the perforated tube through the coverings thereof, by which operation all the liquid is thoroughly filtered and purified.

HONEY BOXES FOR BEE HIVES.—Ellery Channing Lewis, of Glasgow, Mo.—This invention has for its object to improve the construction of honey boxes so as better to adapt them for use, both in connection with the hives and in sending the honey to market; and it consists in a construction of the boxes whereby any box of the series may be removed without disturbing the other boxes, and replaced by a new box; or the honey may be removed and the same box put back in its place. Hexagonal honey boxes are made with slots in their lower sides and with slots in their upper sides to adapt them for use in connection with each other and with a bee hive. The hexagonal boxes are made with their lower sides movable and secured to the ends of said boxes. The boxes are provided with cross slots formed in the upper angle.

BRIDLE BITS.—Albert Vanauken, of Ludlowville, N. Y.—This invention relates to hollow bridle bits, perforated to allow a melted substance to exude therethrough. The mouth piece is made hollow to receive the medicine, and has a number of small perforations formed through its side through which the dissolved medicine or the vapor of the medicine may escape into the horse's mouth. The mouth piece is plugged by metallic screw plugs which carry the rings.

LINK JOINTS FOR WATCH CHAINS.—Charles B. Charpenter, of North Brattleborough, Mass.—This invention has for its object to furnish an improved joint for connecting the links of watch chains, watch guards, etc. It consists in a joint formed by combining two rings with each other and with the end of the adjacent links, which construction gives the necessary flexibility to the chain and produces a chain strong, durable, and substantial, and, at the same time, neat and elegant in appearance.

AGRICULTURAL BOILER.—John Murdock, of South Carver, Mass.—This improvement in boiler furnaces consists in combining therewith a damper for direct draught, wherein the heat is carried completely around the kettle in one united flue. The advantage of the improvement is that the damper is enabled to give a much larger opening where the upper portion of the kettle becomes heated, while opening directly into the smoke pipe; and closing the flue around the kettle, all circulation is effectually arrested. By the arrangement of discharge orifice and damper a direct draught is given to the furnace in starting a fire. The heat may be regulated as may be required by the contents of the boiler, as damage is frequently caused by allowing the full heat of the furnace to pass up around the boiler when the boiling is nearly or quite completed.

APPLE CORER.—Stephen C. Collins, of Oregon, Mo.—This invention relates to a new, simple tool for coring apples, consisting only of a handle and a trough shaped conical cutting blade, which is adapted to core apples of larger or smaller size.

BEDSTEAD FASTENINGS.—Thomas W. Moore, of New York city, assignor to Frances N. Moore, of same place.—The object of this invention is to furnish a cheap, strong, and durable bed fastening. It consists in a flanged metallic angular tenon attached to the bed rail in combination with an angular mortise in the bedpost, the construction and arrangement of the tenon, the holding flanges entirely upon one side of the tenon, and the bearing surface of the wood entirely on one side of the mortise, thus making the fastening secure and durable. The mortise in the post is made by boring a round hole, inclining inward, and then cutting a slot to it from the outside to fit the plate of the tenon so as to leave the bearing surface all on one side of the slot.

MUSIC STAND.—Willard C. James, of Fishersville, N. H.—This invention relates to improvements in music stands; and it consists in a novel arrangement of the rack and legs for being inclosed in a tubular support, adapted to be used as a walking cane, so that it may be more easily carried from place to place than the ordinary racks.

STEAM GOVERNOR.—George W. Clark, of Council Bluffs, Iowa.—This invention consists in the application to the ordinary governor of a weight, to be moved towards or from the fulcrum as a reinforcement to the balls to assist in moving the valve, and apparatus for shifting the weight, said apparatus being actuated in one direction by the steam and in the other by gravity or a spring, to move the ball one way as the pressure increases, and the other way as it falls. We would be glad to describe more at length this ingenious device, but we could not make its action clear without the aid of engravings. We judge it constitutes a very sensitive governor without much complication.

WATER METER.—Camille Campeaux, New York city.—This invention relates to a new instrument for measuring the quantity of water or other fluid passing through it and recording the measurement thus taken. The invention consists in a new arrangement of parts, whereby a float is caused to alternately open and shut a valve and impart intermittent rotation to a recording gear. The nature of the device precludes detailed description in this place.

CORN PLANTER.—Bendix Ingebrigtson, of Cambridge, Wis.—This invention relates solely to certain improvements in the dropping gear of corn planters, whereby the seed is deposited in the drills or hill formed by markers in an accurate and uniform manner.

REFRIGERATOR.—James W. Fisher, of Islip, N. Y.—This invention has for its object to furnish an improved refrigerator which shall be simple in construction, convenient in use, and at the same time strong, durable, and not liable to get out of order; and it consists in the construction and arrangement of various parts which cannot be described without diagrams, but which together form a very convenient and neat design for the purpose intended.

FASTENING FOR WINDOW BLINDS.—Isaac Amos, Belair, Md.—This invention consists in a peculiar construction of pintle for the lower hinge of a blind, whereby the blind is locked and unlocked by sliding the said pintle up and down. The blinds may also be swung open or closed by aid of the device.

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BALANCED VALVE FOR STEAM ENGINE.—David W. Huntington and William A. Hempstead, South Coventry, Conn.—This invention consists in a plate covering a slide valve having a vertical exhaust discharge opening through it, which plate, also having an opening for the exhaust, is provided with a hollow cylinder extending up into another cylinder in the top of the steam chest, in which it fits steam tight, which cylinder prevents the action of the down pressure upon a portion of the plate nearly as large as that under the plate open to the atmosphere, so that there is only a slight preponderating downward pressure, merely sufficient to keep the joint of said plate with the top of the valve tight. As this cylinder on the said plate is liable to bind in the cylinder of the steam chest, in which it must fit steam tight, and thus not always rest on the valve with sufficient pressure, a bar or rod is applied to it, having a slight forward and backward motion to oscillate said plate and prevent it from sticking in the cylinder of the valve chest.

BEE HIVE.—Martin R. Sanders, Cambria Township, Pa.—This hive is of a rectangular form, and provided with a hinged bottom having supports or feet and a side door, with a removable glass panel, to permit easy and safe inspection of the operations of the bees at all times. Ventilating apertures are formed in the bottom and side of the hive, respectively, and closed by pivoted buttons, which are imperforate at one end and provided with wire gauze in the perforation of the other. The gauze affords ventilation, while preventing entrance of vermin into the hive. The door for closing the main bee entrance is attached to the side of the hive by screws working in slots, and notches are formed in the side of the slots to adapt the door to be supported on the screws. The lower edge of the hive is beveled, to allow the bees to work all around the edge, and leave no space for worms or other vermin to find a lodgment. The door is provided with vertical grooves in its side edges corresponding to beads on the hive. Thus a perfectly vermin proof joint is formed, as well as one calculated to keep out moisture, etc. The comb frames have a bottom bar and transverse middle bar, to form supports for the comb, so that it will not be liable to break down when being removed or transported from place to place. They are supported at the back of the hive on fixed cleats or bars, fitting in notches, and at the front by wire hooks. Drawers for surplus honey are arranged to slide into the upper compartments of the hive, and provided with removable glass fronts. When it is desired to remove one of the boxes, it is only necessary to open the glass front, and thus allow the cold air to pass in, which has the effect of immediately driving the bees into the lower part of the hive. Similarly, by removing the glass panel of the door, the bees will be forced into the boxes, and the comb frames may be manipulated with safety. The door is made in two parts—the upper to close the box, and the lower to close the comb frame compartment.

BOTTLE STOPPER.—Wendell Wright, of Phœnicia, New York.—The object of this invention is to provide a stopper for bottles, jars, jugs, etc., which may be inserted and withdrawn an indefinite number of times without injury, and which shall be homogeneous in its texture, and uniform as regards its elasticity. It consists in making the stopper of a block of wood, provided with a deep annular groove, by which the outer bearing surface of the stopper forms a ring, more or less elastic and flexible, according to its thickness and the nature of the wood. These stoppers are very cheaply made, and it is claimed, may be used over and over again without the least injury, besides being superior as stoppers to the ordinary corks used for that purpose.

PISTON PACKING.—Herschel P. McCarroll, of Pittsburgh, Pa.—This invention relates to the use of a continuously self acting expansion spring within the ordinary packing spring of a steam engine or pump piston, and to a new arrangement of interior steady pins. One of the heads has a projecting ring, against which the other head rests. Between this ring and the packing spring is interposed a coiled spring, which bears with constant pressure against the packing spring, and counteracts the contracting efforts of the same. The power of the springs will always be balanced, for the latter becomes weaker as the former is enlarged, and consequently also weakened. In this manner an equal pressure on all points of the packing spring is sustained. To the inner side of the ring is secured a series of springs, which are by jointed links connected with radial steady pins. These pins fit through the ring, and bear, by the power of the springs, against the inner face of the coiled spring. The pins serve to steady the coiled spring and make it act uniformly against the packing spring.

BELL PULL.—Amos L. Swan, of Cherry Valley, N. Y.—This invention relates to a new arrangement of levers constituting a bell pull; and has for its object, by the improved combination, to insure reliable action under a short motion of the pull. By pulling on the knob, levers will be swung so as to carry another lever down, and cause it to pull on the wire that leads to the bell. A short motion of the knob will suffice to produce a complete swing of the latter lever, and insure the desired disturbance of bell or stroke of clapper. On being let go, the knob will, by the power of a spring, be drawn in again and all parts brought back to their normal position.

CONSTRUCTION OF ARCHES.—Frank Alsip, of North McGregor, Iowa.—This invention relates to an important improvement in brick arches, whereby such articles are made to sustain a greater weight, and are more durable than when built in the ordinary manner. It consists in a bearer of metal or other suitable material, supported on the cap piece of the column, and in a cross piece, by which arrangement the wall is sustained by the bearer and column, and the arches are relieved of the greater portion of its weight. The caps may be made in proportion to the size of the column, as the arches may be made much lighter, while the thrust of the arches is much diminished.

CHURN DASHER.—William C. Broyhill and William D. Sperry, of Tremont, Ill.—This invention has for its object to provide farmers and dairymen with an improved churn dasher, which shall be capable of completing the operation of churning more quickly, and also better adapted for use in gathering the butter than others of its class. To this end the under side of the radial dasher blades are grooved, made of wedge form in cross section, and set at an inclination of about thirty degrees to a vertical rotating shaft. The agitation produced by the revolving of the shaft, thus bladed, in the cream soon breaks the globules of butter and completes the process of churning. In churning the dasher is turned so as to raise the cream. In gathering the butter, after the process of churning is completed, the dash is turned in the opposite direction.

PIPE TONGS.—James Stratton, of New Haven, Connecticut.—The griping levers of the pipe tongs, instead of having a steel face made fast to the short jaw, as now practiced, has a circular plate or disk, (preferably of steel) attached to the bottom of jaw, so that it cannot escape therefrom or change its relative position to the upper jaw; but, also, so that it can move on its axial center, and thus continually present a varying surface for wear. In this manner the whole of the belt of contact surface near the edge will wear down together. The top surface is then simply ground down to a plane face, and this is performed again and again until the whole circular plate or disk is worn out and utilized.

MACHINE FOR CUTTING BOOT AND SHOE COUNTERS.—Sylvanus C. Phinney, of Stoughton, Mass., assignor to S. C. Phinney and J. C. Phinney, of same place.—The object of this invention is to furnish a machine for dividing leather, or for cutting it into counters for boots and shoes without waste. It consists in the mode of adjusting a knife, feed rolls, and gage, and in the arrangement of the same in relation to each other; through which a machine is produced, which, it is claimed, divides leather into counters in a most perfect and satisfactory manner, effecting a very great saving in material as well as in time.

FOUNTAIN.—Henry H. Sawwell, of Randolph, N. Y.—This consists of two inclosed chambers and two open pans so connected together by pipes that, when one of the chambers is filled with water, the transfer of the water from the one to the other causes a jet to be projected upwards which will be continued until all the water is thus transferred. The fountain thus constructed is portable and suitable for conservatories, etc.

LIFTING JACK.—Arthur A. Davis, of Clark's Green, Pa.—This invention relates to a new and useful improvement in jacks for lifting carriages, wagons, and other vehicles and articles. When it is desired to drop or lower the lifting bar quickly, a lever is raised higher than is required in lifting, when the end of the lever between cams strikes a lug on an upper catch, and releases the catch from the friction with the bar, and at the same time the toes of the cams strike the outer end of the lower catch plate and release that catch from the bar, when the bar drops by its own gravity.

LAYING TILES.—Manly A. Burnham, of New York city, assignor to himself and Tobias New, of same place, has patented a new and useful improvement in laying tile. This improvement, in laying tile in vestibules, halls, and other apartments, consists in the use of a continuous stone bed or floor above the foundation and "gage mortar," which prevents the tile from being affected by the shrinking, swelling, and warping of the wood foundation beneath. This tile flooring is supported, first, by the foundation timbers or joists, which rest in the walls of the building. On these timbers a flooring of boards or planks is placed. To prevent warping the wood floor is made of narrow pieces, placed so that they may swell without crowding each other. A layer of gaged mortar rests upon the floor, upon which the tile floor is usually placed. This layer of mortar (as tile floors are ordinarily laid) is more or less disturbed by the swelling and warping of the wood floor beneath, and, as a natural consequence, the tile becomes loosened and uneven, and frequent repairs are necessary. As a remedy for these very serious evils, a continuous floor, composed of marble slabs or of stone (either natural or artificial) is embedded in the gaged mortar. Upon this stone floor a layer of plaster of Paris or other suitable cement is spread sufficiently thick to form a level surface. Upon this the tile floor is laid, the tile being bedded down so that the upper surface will present a perfectly level plane. The tile floor supported in this manner will not be affected by the swelling, shrinking, or warping of the wood beneath. The pieces of tile are cemented to the stone floor; and the adhesion of the stone floor to the gaged mortar in which it is embedded being perfect, it is claimed all objection to the floors laid above wood supports is obviated. By the use of the stone floor, a permanent sidewalk or an area may be laid out of doors as well as indoors.

HARROW.—Elial S. Herrington, of Emmett, Ohio.—This invention has for its object to furnish an improved machine for harrowing the ground, breaking up the lumps and clods and leveling off the ground, leaving it light, smooth, and level; the harrow frame is made triangular in form and in two equal parts, which are hinged to each other at the forward and rear parts of the central short longitudinal or line bars by double jointed hinges. This construction enables the two parts of the frame to be turned into a vertical position, so that it may be drawn upon the central bars when passing from place to place, or whenever it is desired that the harrow should not operate upon the ground. The harrow teeth are attached to the frame in the ordinary manner, except that the two teeth attached to the rear parts of the central or line bars are made longer than the other teeth, to take a firmer hold upon the ground. A box, open upon its upper side, has its ends inclined, so that it may fit into the space between the rear parts of the inclined or outer side bars of the triangular frame. To the forward parts of the ends of this box are pivoted the ends of a bail, the middle part of which is connected with the rear hinge, or with the rear part of the said frame by a short rod or chain. Two boxes placed in the rear of this box, the ends of the forward one being connected with the ends of the first box by short rods or chains, and the ends of the rear one of which are connected with the ends of the other one by short rods. To one of the boxes, preferably the middle one, is attached a seat for the driver. If desired, the boxes may be weighted with stones or other heavy material when additional weight may be required for breaking the clods and leveling the ground.

REIN AND SHAFT SUPPORT.—James P. Crutcher and Thomas Y. Vancleave, of Connersville, Tenn.—This invention consists in a new line supporter applied to buggy shafts or carriage poles, so that it will also serve to support the rear ends of such shafts or poles, when detached from their vehicles, on the animals' backs and preserve them from injury.

COMBINED CLOTHES DRYER AND AWNING.—Charles E. Hyde, Oswego, N. Y.—This invention consists in the combination of a frame with an awning which latter can be used either in connection with cords stretched on the frame for the purpose of forming a clothes dryer, protected by the awning from rain, or may be used without the cords, simply as a tent.

FASTENING FOR CORRUGATED ROOFING.—John C. Wands, Nashville, Tenn.—This invention relates to a device for fastening together sheets of corrugated roofing by means of a Z shaped clamp into whose angles the edges of the upper and lower sheets are passed, the same being thereby prevented from springing apart.

CARRIAGE SEAT JOINT.—John A. Hanna, Belair, Md.—The invention consists in forming swells or extensions on each side of the joint so as to produce large planes for bearing surfaces and thus secure the shoulders from being staved up; also in a flap that automatically removes the dress and prevents it from being caught.

CLOTHES WASHER.—David P. Sulouff, Milton, Pa.—This invention relates to a washer intended to go inside a wash boiler and to support the clothes to be washed, holding them above the water, and provided with a pipe having a rose head through which water is forced by the steam pressure, falling from the rose heads in jets on all parts of the clothes.

CLOTHES WASHER.—David B. Sulouff, Milton, Pa.—This invention relates to a washer intended to go inside a wash boiler and to support the clothes to be washed, holding them above the water, and provided with pipes, one at each end, having rose heads through which water is forced by steam pressure, falling from the rose head in jets on all parts of the clothes.

SASH FASTENER.—John C. Hanna, Rossville, Iowa.—This invention consists of a device formed of two plates pointed together like a butt hinge, one of which plates is to be let into the side of a window sash, the hinge being placed next to the casing; the other plate being free and provided with a right angle flange at its upper or lower end, which flange, when the free plate is turned back against the casing, enters one of several slots, and thus fastens the window.

COTTON PRESS.—Charles J. Beasley, Petersburg, Va.—This invention relates to that class of presses which employ two followers, one moving upwards and the other downwards. The invention consists in the combination of two such followers, in such a manner that the lower one in rising draws down the upper one part of the way, and when descending raises the upper one. It also consists in the construction and arrangement of a lever for operating the shaft on which are mounted the cords for adjusting the followers. And it finally consists in the combination with said shaft of a horse power for drawing the followers together when it is preferable that the other apparatus for doing the same thing should not be used.

STEAM AND WATER INJECTOR.—Samuel S. Jamison, Jr., Saltsburg, Pa.—This invention relates to the steam injector used for filling boilers with water, and it consists in a double conical piece of metal placed within and lengthwise of the conducting pipe of the instrument, in front of the steam and water supply pipes, an annular space being left between said conical piece and its inclosing pipe for the passage of water to the boiler, the object of the conical piece being to more thoroughly commingle the steam and water than would otherwise be done, and, consequently to more rapidly and completely condense the steam.

BUGGY REACH.—John Clinton Hillsabeck, of Montovallo, Mo.—This invention consists in the provision of certain attachments to buggy reaches whereby a degree of flexibility is given to the vehicle which preserves it from damage, and by which the sudden jerks given to the body by rigid running gear are avoided. The improvement allows either wheel to pass through a hole or over an obstruction without, it is claimed, straining either the axle or any other part of the running gear.

## APPLICATIONS FOR EXTENSION OF PATENTS.

SPLICE FOR JOINTS FOR RAIL ROAD RAILS.—John H. Norris and Edward W. Scudder, Trenton, N. J., executors of Mark Fisher, deceased, have petitioned for an extension of the above patent. Day of hearing, Feb. 21, 1872.

CONTINUOUS METALLIC LATHING.—Birdsall Cornell, New York city, has petitioned for an extension of the above patent. Day of hearing, Feb. 14, 1872.

COTTON GIN.—Benjamin David Gullett, Amite, La., has petitioned for an extension of the above patent. Day of hearing, Feb. 7, 1872.

SHOVEL PLOW AND CULTIVATOR.—Paul Dennis, Schuylersville, N. Y., has petitioned for an extension of the above patent. Day of hearing, Feb. 7, 1872.

SHOE PEG MACHINE.—Abijah Woodward, Keene, N. H., has petitioned for an extension of the above patent. Day of hearing, February 7, 1872.

SEWING MACHINE.—Charles F. Bosworth, Milford, Conn., has petitioned for an extension of the above patent. Day of hearing, April 4, 1872.


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121,238.—COVER.—A. S. Dyckman, South Haven, Mich.
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121,241.—LANTERN.—A. French, Phila., Pa.
121,242.—CURTAIN FIXTURE.—J. Gray, Medford, Mass.
121,243.—FLOOR.—F. E. Hall, Bridgewater, Mass.
121,244.—HAY PRESS.—F. F. Hamilton, Green Bay, Wis.
121,245.—MELTING CHIPS.—E. C. Haserick, Lake Village, N. H.
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121,254.—CRUTCH.—E. T. Pearl, Milwaukee, Wis.
121,255.—CAR SEAT.—A. Prier, Milwaukee, Wis.
121,256.—PRINTING PRESS.—G. W. Prouty, Charlestown, Mass.
121,257.—RENOVATOR.—S. B. Shoemaker, Willoughby, Ohio.
121,258.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.
121,259.—HINGE.—W. A. Slaymaker, Atlanta, Ga.
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121,264.—CUTTING WEDGES.—N. Warner, Jasper, Ind.
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121,268.—GIRTH.—S. W. Baker. Providence, R. I.
121,269.—BLOWER.—J. F. Barker, Springfield, Mass.
121,270.—WHEEL, ETC.—J. W. Beal, South Scituate, Mass.
121,271.—BUTTON.—G. F. Beardsley, Binghampton, N. Y.
121,272.—DESTROYER.—J. M. Bennett, Jaynesville, Iowa.
121,273.—HOLDER.—F. Bruns, Cleveland Ohio.
121,274.—HANDLE.—H. R. Butterfield, Vassalborough, Me.
121,275.—LIFE RAFT.—H. C. Calkin, New York city.
121,276.—STAND PIPE.—M. Coombs, Jr., Youngstown, Ohio.
121,277.—GUN.—L. Christophe, J. Montigny, Brussels, Belgium
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121,281.—HORSE POWER.—H. C. Drew, Jamestown, Mich.
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121,394.—BURNER.—R. S. Merrill, Boston, Mass.
121,395.—BOILER.—J. H. Mills, Boston, Mass.
121,396.—SAWER.—J. K. Milnor, Baltimore, Md.
121,397.—PAVEMENT, ETC.—G. H. Moore, Norwich, Conn.
121,398.—FURNACE.—T. H. Moore, Alexandria, Va.
121,399.—SPICE BOX, ETC.—B. Morahan, Brooklyn, N. Y.
121,400.—SHOE BINDING.—C. E. Morrill, Deering, Me.
121,401.—ESCAPEMENT.—D. J. Mozart, New York city.
121,402.—ICE.—A. Muhl, San Antonia, Texas.
121,403.—WAGON.—W. A. Nichols, Zionsville, Ind.
121,404.—DRYER.—R. L. Normando, Higginville, N. Y.
121,405.—BELT.—M. Olmstead, Alum Creek, Tex.
121,406.—PLANE.—S. W. Palmer, E.G.Storke, Auburn, N, Y.
121,407.—CAPSULING.—J. Paterson, Edinburgh, N. B.
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121,420.—SCALE BEAM.—W. W. Reynolds, Brandon, Vt.
121,421.—SHIELD.—H. Rieger, Beaufort, N. C.
121,422.—FURNACE.—J. M. Roberts, Burlington, N. J.
121,423.—FAIR LEADER.—A. W. Robinson, Providence, R. I.
121,424.—FIELD ROLLER.—A. Rogers, Freeport, Ill.
121,425.—Not issued.
121,426.—BOILER.—J. Shand, London, England.
121,427.—ENGINE.—L. D. B. Shaw, Boston, Mass.
121,428.—TONGS.—E. R. Shepard, Binghamton, N. Y.
121,429.—HYDRANT.—J. Small, Washington, D. C.
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121,444.—HOLDER.—J. T. Woods, E. H. Leseman, Toledo, O.
121,445.—SEDIMENT COLLECTOR.—A. Zipser, Biala, Austria.
121,446.—OVERSHOE.—A. O. Bourn, Providence, R. I.

## REISSUES.

4,645.—REFRIGERATOR.—A. Fuller, L. P. Reichert, Buffalo, N. Y.—Patent No. 74,813, dated February 25, 1868.
4,646.—PRINTING PRESS.—M. Gally, Rochester, N. Y.—Patent No. 97,185, dated November 23, 1869.
4,647.—WHIFFLETREE.—G. and W. Gibbs, Canton, O.—Patent No. 75,408, dated March 10, 1868.
4,648.—FARE BOX.—J. B. Slawson, New York city.—Patent No. 105,005, dated July 5, 1870.
4,649.—CORDS.—J. Turner, Norwich, I. E. Palmer, Montville, Conn.—Patent No. 38,190, dated April 14, 1863; reissue No. 3,345, dated March 30, 1869.
4,650.—CAN.—O. S. Camp, Grand Rapids, Mich.—Patent No. 118,904, dated September 12, 1871.
4,651.—Division A.—BROILER.—D. E. Roe, Elmira, N. Y.—Patent No. 106,210, dated August 9, 1870.
4,652.—Division B.—BROILER.—D. E. Roe, Elmira, N. Y.—Patent No. 106,210, dated August 9, 1870.
4,653.—FLUTER.—S. G. Cabell, Quincy, Ill.—Patent No. 83,924, dated November 10, 1868.

## DESIGNS.

5,379.—CARPET.—J. Barrett, New York city.
5,380.—CARPET.—A. Beck, Phila., Pa.
5,381 to 5,389.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,390 & 5,391.—CARPETS.—A. Heald, Phila., Pa.
5,392.—CARPET.—O. Heinigke, New York city.
5,393.—OIL CLOTH.—J. Paterson, Elizabeth, N. J.
5,394 & 5,395.—STOVES.—R. Scorer, R. Ham, Troy, N. Y.

## TRADE MARKS.

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562 & 563.—SCYTHES.—The Dunn Edge Tool Company, West Waterville, Me.
564.—SHEET IRON, ETC.—A. Wood & Co., Phila., Pa.

## EXTENSIONS.

SEEDING MACHINE.—A. Franklin, of Genoa Cross Roads, O.—Patent No. 18,579, dated November 10, 1857; reissue No. 3,310, dated February 23, 1869.
OPERATING FLY FRAME.—R. M. Hoe, of West Farms, N. Y.—Letters Patent No. 18,640, dated November 17, 1857.
TURNING WOODEN BOXES.—A. S. Newton, of Brandon, Vt.—Letters Patent No. 18,646, dated November 17, 1857.
TURNING PILLARS FOR CLOCK MOVEMENTS.—W. H. Nettleton of Bristol, Conn., C. Raymond, of Guelph, Canada, and A. Hatch, of New Haven, Conn.—Letters Patent No. 18,661, dated November 17, 1857; reissue No. 3,489, dated June 8, 1869.
SNUFFERS.—O. W. Stow, of Plantsville, and A. Barnes, of Southington, Conn.—Letters Patent No. 18,713, dated November 24, 1857.
SAFETY LAMP.—W. Pratt, of New York city.—Letters Patent No. 18,704, dated November 24, 1857.
TRUSS.—J. W. Riggs, of Brooklyn, N. Y.—Letters Patent No. 18,708, dated November 24, 1857.
SPREADING FERTILIZERS.—P. Seymour, of East Bloomfield, N. Y.—Letters Patent No. 18,774, dated December 1, 1857.
ROLLING BEAMS.—J. Griffin, of Phœnixville, Pa.—Letters Patent No. 18,738, dated December 1, 1857.
THREADING BOLTS.—W. Sellers, of Phila., Pa.—Letters Patent No. 18,775, dated December 1, 1857; reissue No. 656, dated February 8, 1859.


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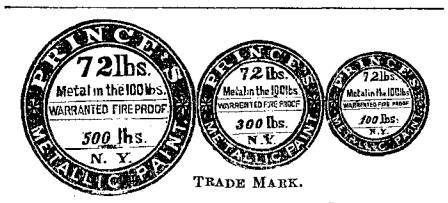

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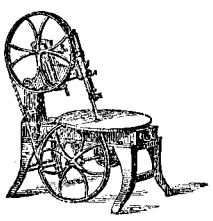

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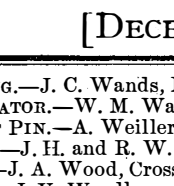

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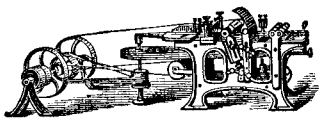

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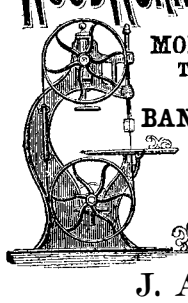
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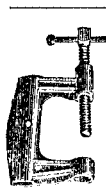
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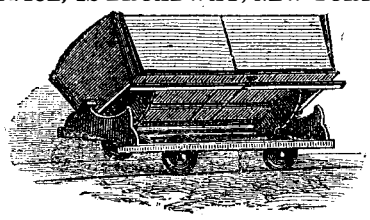
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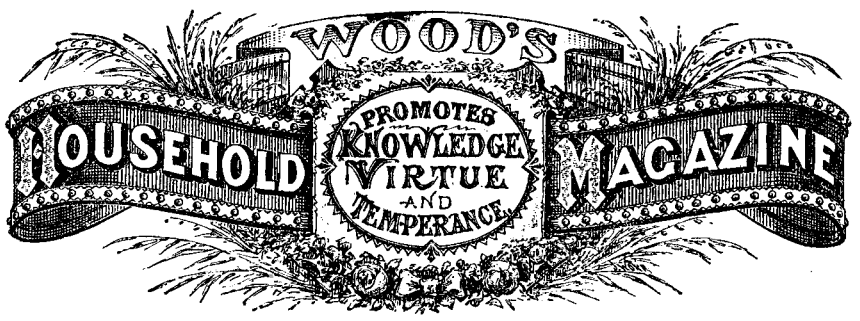


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### A Letter from Mrs. Henry Ward Beecher.

While overhauling our papers, after the recent removal to our new quarters, we came across the following letter, which so appropriately expresses the general sentiments of those who read our Magazine, that we have concluded to publish it.

BROOKLYN, February 11th, 1871.

S. S. WOOD:—

DEAR SIR,—In '69, while I was editing "The Mother at Home," I was much interested in a few copies of your "Household Magazine," which found their way into my house, whether to me or my husband, I do not know, nor does it matter. I was so much pleased that I wrote, asking for an exchange, but receiving no answer, I let the matter drop. I write now, enclosing two dollars, with the request that if you can furnish me the whole set of 1870, you will do so, and also put me down as a subscriber for 1871. If you have not a set of 1870, please, for the extra dollar, put my daughter down for 1871, directing to Rev. Mrs. Samuel Scoville, Norwich, Chenango Co., N. Y.

I think one copy comes to the office of the "Christian Union," edited by my husband, but I prefer to have one copy sent to the house for my own use.

Direct last year's numbers, if you have them, and this year's edition, if you please, to Mrs. Henry Ward Beecher, 124 Columbia St., Brooklyn, N.Y., and oblige yours, respecfully,

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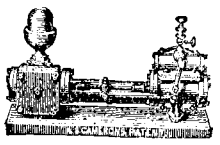

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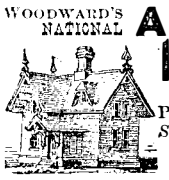

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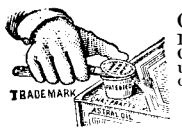


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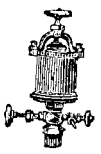

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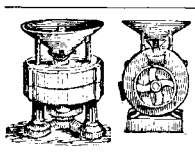

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